Natural History in Zoological Gardens

Frank E. Beddard

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NATURAL HISTORY IN ZOOLOGICAL GARDENS

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Natural History in Zoological Gardens

BEING SOME
ACCOUNT OF VERTEBRATED
ANIMALS, WITH SPECIAL REFERENCE TO
THOSE USUALLY TO BE SEEN IN THE ZOO-
LOGICAL SOCIETY'S GARDENS IN
LONDON AND SIMILAR
INSTITUTIONS

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Preface

I GIVE in the following pages an account of one hundred and seventeen kinds of animals, with shorter references to some others, the great majority of which are certain to be represented in most Zoological Gardens. These types of vertebrate life are placed in due relation to each other by some details concerning the structure and classification of the vertebrata, which precede in an orderly way the sections referring to those several types. The volume thus contains a sketch of vertebrate life which may serve as an introduction to more exhaustive studies. It will also, I hope, be of some assistance to those who desire to know something of the great variety of animal life exhibited in these institutions, and as a guide to the mammals, birds, reptiles, and amphibians therein collected together.

FRANK E. BEDDARD.

October, 1904.

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CHAPTER I

Introductory

THE large collection of living animals belonging to the Zoological Society contains at any given time representatives of all the principal families of vertebrated animals, as well as a few invertebrates, such as insects, scorpions, and the like, which latter are harboured in the Insect House. The great wealth of that collection will give some notion of the extreme productiveness of Nature, and will also emphasize the great uniformity which underlies so much superficial diversity. With its wild, that is uncaged, inhabitants the Zoological Gardens represents in a few square yards the animal population of the globe. For all the great groups into which animated nature can be divided have here their representatives. Animals, in fact, fall into only about a dozen main groups or Phyla. At the bottom of the series we have the unicellular organisms, as a rule of minutely microscopic size and rarely visible at all to the naked eye; these comprise an infinite variety of creatures, called by the earlier investigators Infusoria, since they appeared in infusions of organized matter. There is not a pool or even puddle in the Zoological Gardens which has not its population of Amœbæ and many other of these Protozoa. The remaining Phyla are multicellular organisms collectively termed Metazoa. The first group of the Metazoa, that of the Sponges, may perhaps be represented by the fresh-

water sponge in the canal which cuts the gardens in two. The Jelly-fish and Sea-anemones—at any rate the latter—have constantly been on view in the Fish House. The Mollusca are present in the shape of slugs and snails upon the paths and occasionally of large tropical land shelled forms in the Insect House. The Appendiculata, including the vast series of organisms ranging from the earthworm and its kindred at the lowest step of the series, and culminating in the insects, are plainly well represented. The Nematoidea, or thread worms, lurk as parasites among the caged animals, as do also certain of the members of the seventh great phylum, the Platyhelmia. The Echinodermata (starfish, sea urchins), will not be found. Nor does the collection contain examples of two groups of marine or terrestrial "worms," the Chætognatha and Nemertina. Finally the Chordata include the Vertebrata, with which we are concerned here; and it is this group which the Zoological Society considers it is its business to exhibit with the greatest possible lavishness in variety of genus and species. It is worth bearing in mind that the animal life of this planet is constructed upon such few types while its variety in modifications upon these types is so enormous.

What holds good of animal life in general is also true of the vertebrata alone. It will be plain from quite a cursory inspection of the collection that all vertebrata arrange themselves round at most five types, viz. mammals, birds, reptiles, amphibians, and fishes. It behoves us, however, first all of to enquire what a vertebrate is; we can then proceed to consider the various types of vertebrates offered for our studies in the gardens of the Zoological Society, and other gardens abroad.

As the name denotes, the vertebrata have a backbone, a series of bones known as vertebræ, which is dorsal in position, and underlies as well as enwraps the brain and spinal cord, the central nervous system. This backbone

is preceded and sometimes, as in the lower fishes, co-exists with the unjointed skeletal rod, the notochord whose presence characterizes the entire phylum Chordata. They breathe too by means of perforations fringed with gills which put the front end of the alimentary tract in communication with the outside world, or at least possess in the embryo traces of these breathing organs. The gill slits of fishes are these organs and more will be said concerning them on a later page. The vertebrata moreover possess a skull, a series of bones surrounding the brain ; they have also two pairs, and only two pairs, of limbs, which, however, may partly or entirely disappear (e.g. snakes, some lizards, etc.). These limbs are provided with a skeleton. The central organ of impulsion of the vascular system, the heart, is always ventral in position. No animal that is not a vertebrate combines these characters in itself.

These necessarily technical details now require some expansion and explanation. All the vertebrata possess a brain and a spinal cord, running along the back, and lying within the bony or gristly tube known as the vertebral column. The brain is enclosed in an expanded bony or gristly box, the skull. It is only in certain lowly organized fishes, such as the sharks, that the skull and vertebral column is entirely made of gristle or cartilage ; in the higher types this cartilage becomes bone, more completely so in the highest types, such as the mammalia, and less completely so in many lower types, such as the frog. In no creature belonging to the different phyla, which were originally grouped together under the name of Invertebrata, is there such an axial skeleton enclosing the whole of the central nervous system. It is commonly and loosely said, that in vertebrates the skeleton is internal, and in invertebrates—if there be a sketeton—it is external. That this is not strictly true is shown by the external skeleton in the shape of scales

in the lizards, and by the internally placed "sternal plate" in scorpions, etc. The proper way to put the difference is that in all Chordata a supporting rod wholly or partly underlies the central nervous system, and that in all vertebrata the entire central nervous system is completely sheathed in a tube of bone or cartilage, which partly or entirely replaces that axial supporting rod; and that in no "Invertebrate" is this the case.

All vertebrates possess two pairs of limbs; these are the paired (not the unpaired dorsal and ventral) fins of fishes and the legs and arms of frogs, reptiles and mammals, and of course the wings and legs of birds. No vertebrate possesses more than these two pairs, and it is nearly invariably the case that both pairs are present, or that, if missing, there is evidence that absence is due to disuse and to degeneration. Thus the whales have no hind limbs, but they possess in most cases tiny bonelets which can be identified as the rudiments of the missing limbs. In some snakes the otherwise entirely missing limbs are represented by minute fragments in the neighbourhood of the vent, which can also be identified with limbs. There is only one type of vertebrate life which seems to have no traces of limbs and that is the lampreys. Undoubtedly, these fishes lie near to the base of the vertebrate series, and it possible that they have, so to speak, not yet acquired the typical vertebrate limbs; or, on the other hand, it is possible that they have lost them entirely, as the snakes are presumed to have lost their fore limbs.

Many invertebrate creatures have limbs; the insects for examples. An exact comparison, however, between these appendages and the limbs of vertebrata is impossible, and in any case the number is not limited to two pairs as in the group which we are considering here.

The next point of importance is the condition of the respiratory organs in the vertebrata. In all the

Chordata, which it will be remembered is the large group or phylum including, not only the higher vertebrata, but the series of lower forms which are distributed among the classes of Ascidia and variously lowly organized marine creatures, the pharynx—that is the anterior part of the alimentary tract behind the mouth—is perforated by a series or many series of slits, putting it into communication with the outside world, which in the forms where this arrangement is fully developed is always water. The water rushes into the pharynx by means of these clefts, and parts with its dissolved air containing oxygen to the small blood vessels which fringe the sides of the clefts. Thus is respiration effected. That this arrangement occurs in the vertebrata may be easily seen by the inspection of any fish, and among the dogfish and skates the details are plainer than in some others. In those fishes a row of holes is to be seen along the throat; and if a probe of any kind be passed through it, will be found to emerge in the throat cavity. Furthermore, the edges of the clefts are seen to be furnished with red tufts, which are the gills, and are practically an agglomeration of small blood vessels divided only from the water which washes them by a thin membrane through which the dissolved oxygen can pass. In vertebrates above fishes the gills along the clefts entirely, or nearly entirely, lose their function as breathing organs. It is only in certain Amphibia that the clefts in question remain throughout life, and then in diminished numbers; but in the tadpoles of all of these clefts are present, and associated with the respiratory function. It might seem therefore that this important character was only one that applied to the lower vertebrata; and in its full development it does only so apply. But the study of the development of animals, that is embryology, has shown that in reptiles, birds, and mammals, traces of these same gill clefts are to be seen; and one of them,

though dissociated from the respiratory function, remains for life. That cleft is the external ear hole, which opens internally by what is called the eustachian tube into the pharynx. Thus, though the gill clefts in the higher vertebrates are no longer used for breathing purposes, being replaced by the lungs, they persist for a time to emphasize the relationship between the higher and the lower vertebrates.

The ventrally placed heart is another marked characteristic of the vertebrata. The beat of the heart in man is felt through the chest walls and not through the back. In all animals the heart has the same position ; it lies on the opposite side of the body to that which lodges the brain and spinal cord. In many invertebrate animals the position of these two important organs is exactly the reverse. In worms, insects and crustaceans, the heart, if it exists, is on the dorsal side and the larger portion at any rate of the central nervous system is on the ventral side, the side upon which the animal progresses, or which is turned towards the ground in progression as in those animals which possess legs.

Anatomy reveals many other characteristics of vertebrate animals ; but the principal ones are those which we have just briefly sketched. The large assemblage of creatures classifiable as vertebrates splits up readily into the five sub-groups mentioned above, all of which are considered in the following pages.

CHAPTER II

Characters of the Mammalia

INACCURATE though the term undoubtedly is (for all "mammals" do not possess mammæ, or teats) in application from derivation, it is better to adhere to the expression in lieu of something better, than to use or revert to the entirely wrong vernacular words in common use, viz., "Quadrupeds," "Beasts," or "Animals." For lizards are quadrupeds, and the converse of animal is clearly vegetable or mineral. "Beasts" might be retained, but that it has a somewhat insulting suggestion. The justification of the term, however, is less important than its meaning. What are we to understand by mammals or mammalia? For us who are concerned here only with living mammals, the distinction from other backboned animals is quite easy and obvious, even without having recourse to bony and other structural characters. By external form and character only, if rightly put, it is within the power of any one to recognize clearly the features which enable him to assert positively that a given animal is or is not a mammal. It is, in the first place, not correct to define mammals as quadrupedal; most of them are so indeed, and all that especially concern us in this place. But if we attempt to make definitions that suit the entire "class," it is requisite to allow for these exceptions. To begin with, man is not

quadrupedal except occasionally and during his young stages ; the whales are clearly not so ; neither are the manatees and dugongs ; the bats, it is true, do shuffle along on their "wings" as well as by the aid of their hind limbs ; but it would be straining the proper use of the term to describe them as "quadrupeds." But when quadrupedal, as in the vast majority of mammals, the fore and hind limbs lie beneath and actually support the body more directly than in the other quadrupedal group, the Reptiles. In the latter it will be noticed that the body is, as it were, slung between the legs like the body of an eighteenth-century coach between its wheels ; in the mammals the legs support the body as its legs do a chair. We may, however, legitimately say that the mammalia are much more generally quadrupedal than are the reptiles, of which (see below) so many are entirely or partially legless. The next point is one which absolutely distinguishes *all* mammals from *all* other vertebrates (and, of course, invertebrates). This feature is the covering of hair. To this statement there are no real exceptions, but several apparent exceptions, which we must note. The apparent exceptions, again, are of animals which really do not enter into the subject matter of this volume. A very little observation will convince any one that the almost naked rhinoceros has some vestiges of a hairy covering. But the whales, again, which contradict so many generalizations about the class mammalia, are rather more deceptive. Their covering of hair is reduced to a few hairs in the neighbourhood of the mouth. If these were to go it would be most difficult to state definitely, from external characters only, that a whale was not an aquatic reptile like the *Ichthyosaurus*. There are, moreover, a series of exceptions on the other side. Some of the feathers of flightless birds, such as the *Apteryx*, have to the naked eye every appearance of hairs. Their microscopic character, and

the way in which they develop in the embryo, can alone settle the fact that they are not hairs, but true, though somewhat rudimentary, feathers. But no practical difficulty arises in this case ; for on other parts of the body are plenty of obvious feathers which no mammal ever possesses.

A third feature is also absolutely distinctive, and that is the presence in the female, with rudiments in the male, of cutaneous glands which secrete milk for the nourishment of the young when born. No other vertebrate possesses anything even remotely resembling the mammary glands of the mammalia.

A rash observer might say that mammals are never scaly, while reptiles, fishes, and even birds (their feet) are always so. It is difficult, however, to distinguish accurately the scales upon a rat's tail from those of a lizard, though it is true that the scales of the pangolin, or scaly ant-eater of Africa and India, are not real scales, but merely agglutinated hairs.

No one can look at the head of a mammal, that is of course of a terrestrial mammal (for here again, as in so many features, the whales are exceptional), without observing how impossible it is to mistake that group for any of the lower lying groups of vertebrate animals. With a few exceptions—such as the seals as well as the whales already mentioned and a small selection of other mammals—external ears are present in that group, and often of conspicuous size. In the lizards, frogs and birds the external ear is absent, and there is merely the external auditory passage visible, covered by the tympanic membrane ; and even that is not always present. Coupled with the presence of ears is a look of alertness, quite distinctive of the mammalia, and a more fidgetty demeanour than that of lower vertebrates, except of course birds. There is but little torpidity among mammals save in those few cases, such as the hedeghog, where the animal

hibernates. They do not remain for hours in a motionless condition save when asleep.

So far as external characters are concerned the above observations embody the principal points in which the group differs from those of vertebrates lying lower in the series. There are, however, still remaining, a few characters which are highly noteworthy among the mammalia without being absolutely diagnostic. It will be readily observed in reviewing the large series of mammals at the Zoo, and comparing them with the larger series of birds, that the mammalia for the most part are clad in a sober livery. There is nowhere in the group that development of brilliant primary colours such as we see so very commonly among birds. There are no reds, greens and blues, the utmost brilliancy of hue being bright browns contrasting with white, and a few brighter colours, not of hair, but of naked skin, such as the muzzle and ischial callosities of some monkeys. If may be that correlated with this absence of striking coloration is the predominance of the senses of smell and hearing over sight. It is broadly true of the mammalia, that they smell and hear rather than see. While of birds it is equally true to say, that they see rather than smell. That this point of view is in the main correct is shown by another very characteristic feature of the mammalia. In various parts of the body glands open on to the surface ; these glands produce variously smelling secretions, of which musk, civet, and castoreum, are examples. The odoriferousness of the houses in which the mammalia are confined is an unmistakable proof of this ; and the fact that birds are at least by no means so strongly smelling convinces us of the absence of glands in the skins of those animals. The same may be said of reptiles and amphibia, broadly considered—for here as elsewhere there are exceptions. There are for example musky smelling glands among

the Crocodilia. It is quite conceivable, and indeed one cannot help arriving at the conclusion, that mammals recognize each other far more by odour than by sight. Perhaps this physiological fact has something to do with the general absence of brilliant hues among the mammalia. There is no difficulty therefore about distinguishing a mammal from any other vertebrate by merely inspecting it in a cage. But it will be necessary to delve a little further into the subject, and to add something to the characters of this group from a consideration of certain anatomical features. The reason for this is obvious. For without reliable distinguishing marks derived from the skeleton it would be impossible to place accurately the bones and teeth of fossil forms, of whose soft parts, including the skin, no trace remains in the rocks. It is true that we are not specially concerned here with extinct mammals or fossil vertebrates generally. But it would be taking a too limited view of zoology to completely ignore the fact that there *were*, as well as *are*, mammals. A very marked feature of the mammalian skeleton is the fact that the bones of the vertebral column as well as for the limbs are not, so to speak, in one piece. At either end of the vertebra, for example, is a little disc known as the epiphysis, which ossifies separately from the main body of the vertebra, and remains distinct for a long period. The same takes place at the ends of the long bones of the arm and leg and the smaller bones of those appendages also.

In the skull of a mammal the lower jaw is all in one piece, instead of being obviously made up of a number of separate bones as it is in reptiles, etc., and, moreover, the mandible articulates with a large bone in the skull known as the squamosal, and not with a special small bone termed in reptiles and amphibia, the quadrate. At the end of the skull, where it articulates with the

vertebral column, there are two projecting condyles to effect this articulation, whereas in reptiles there is but one, although that one may show signs of division. The practical effect of this is seen by the fact that a mammal cannot twist its head to look directly backwards like a bird can. The teeth of mammals generally (but here there are exceptions, such as the whales) are divisible into three distinct sets ; there are the small incisors in front, the canines follow them, and the molar or grinding teeth complete the series. The human jaw will illustrate this mammalian feature satisfactorily, though the canines are in most persons not so marked off from the last incisor in front of them and the first premolar which follows. Still, many have "eye-teeth," as the canines are sometimes termed, which are prominent enough. Now in reptiles and amphibians there is never so marked a differentiation into series as there is in mammals. Furthermore (except again the whales) the mammal has a limited number of teeth, the very outside numbers being a trifle over fifty, as in certain marsupials, while the reptile and the lower vertebrate generally has frequently a large and almost indefinite series. It has truly a mouth full of teeth. Some reptiles, such as tortoises, and some amphibians, such as toads of various kinds, are completely without teeth, like the ant-eaters among mammals. But if teeth are present, the characters just emphasized are usually to be seen. These, however, are general characters ; practically the zoologist does not consider them, for the reason that he directly compares the given fossil bone with the nearest thing in the bones of living animals. For information of this kind the reader must consult larger treatises, or still better, make himself acquainted with the skeletons at museums. Even then, with fragmentary remains which are so often—it is to be regretted—the only vestiges of formerly existing

animals, it is not always possible to decide whether a given fragment is really of a mammal or a reptile. There is a famous fossil, the fragment of a skull of an animal, which has been named *Tritylodon*; it is not fully agreed whether this creature was a mammal or a reptile. In the case of such a fragment as a bit of a long bone or a finger bone, the problem would be still harder, and often insoluble.

With living mammals and living reptiles there is no difficulty at all in distinguishing them by bony and other characters. With a skull or the entire skeleton before him, no one could fail to recognize the few features to which attention has been directed. And there are of course many others, to enumerate which would be too long a task here.

The internal anatomy of a mammal is constructed upon the same general plan as is that of a reptile or an amphibian, as has been already set forth in our general description of the vertebrata. But there are important differences of minor weight which differentiate the mammal from all other vertebrates. The most important of these is the fact that in the mammal the heart and lungs lie in a separate chest cavity, divided off from the abdominal cavity, which contains the liver, intestines, kidneys, and so forth, by a muscular partition, known as the diaphragm. In all mammals this character holds good; and in no animal which is not a mammal is there any structure *exactly* comparable to this diaphragm.

§ Classification of Mammals

Having now got at a notion of what a mammal is as compared with other vertebrates, it is requisite to see how far the mammalia can be conveniently subdivided among themselves; for it will be plain to the least

instructed person that this large group contains some exceedingly diverse types. Consider for a moment a monkey, a bat, a whale, a horse, and a cat. It is plain that though all are mammals (judged by the tests which we have used above), they exemplify very extreme types, radiating, it may be, from a common centre. Now a proper classification is one which most nearly represents true relationship; this may seem to be a remark hardly worth making, on account of obviousness. But nevertheless the history of the classifications of mammals and of other animals show that, obvious though it may be, the truth of the remark has not been generally laid hold of.

Now relationship implies and is proved by a common descent. To apply this method to classification is of course a counsel of perfection not yet attainable, though in some cases the study of extinct forms has given us a fairly complete series of gradations from type to type. To take one example: the South American lama and the Old World camels can be traced back to an extinct form, *Procamelus*, which appears to combine the divergencies of the two, and to be thus the ancestor of both. The descendants of a parent form must clearly be related. The advance of Palæontology will doubtless make other relationships clear. Furthermore it is plain that the degree of relationship depends upon the nearness or remoteness of the common ancestor: For instance, the lama and the camel soon converge in an apparently common ancestor; on the other hand the two great divisions of the Ungulates, whose characters will be dealt with in succeeding pages, viz., the Artiodactyles and the Perissodactyles, retain their characters for a long period of time; and it is not until the early Eocene period that we arrive at forms, with many intervening lacunæ, unfortunately, which may possibly be looked

upon as ancestral to both. The method of Palæontology, however, has at present to be supplemented by comparative anatomy. Relationship not only implies common ancestry but likeness of structure, which is more or less marked according to the degree of relationship. But here we leave the region of fact for that of inference. Palæontology, in proportion to the completeness of the records in the rocks, speaks with a certain voice as to relationships. Similarity of structure has to be sifted and checked in various ways before it can be relied upon as evidence. We will take some cases, beginning with extremes, to illustrate the matter. The paca is a large brown rodent, with white spots. The dasyure is an equally sized Australian marsupial, also with a brown coat, diversified with white spots. Why don't we, or do we, put together these two animals? We do not admit a close relationship for the following reasons:—In the first place white spots on a brown or dark ground is a plan of coloration found in many diverse kinds of animals between which no intimate relationship is at all possible, which are of course *a priori* conditions between two mammals. Molluscs, insects, and other creatures have a host of representatives which possess this character. It would be tantamount to bracketing together green animals and white animals, black creatures and transparent creatures, a procedure which would involve too many obvious absurdities to be entertained for a moment. A second reason forbids us from laying any stress on the white spots. In South America, where the paca lives, there lives also the agouti. In the Australian continent and its outlying islands, where we find the dasyure, the Tasmanian devil is also to be met with. Now neither the agouti nor the Tasmanian devil are brown spotted with white; and yet, in every other detail of external and internal structure, the Tasmanian devil

is so closely like the dasyure, and the agouti is so like the paca, that we must bracket then two and two, as written above. So manifold are these respective points of likeness that even if white spots on a brown ground were not found in certain deer, as well as in other animals, they would necessarily cease to have any weight in comparison with the vast preponderance of likeness over dissimilarity shown by the other parts of the body. In this case an enormous majority of points of likeness or difference indicates the relative closeness of the affinity.

It is not safe, however, to trust to majorities in zoological as in other matters, or else we might soon find ourselves in the position of the orator who asserted that if his adversary had documents, so had he, and he held that one document was as good as another. For one character is not as good as another, and arguments based upon any leaning towards such a view would be sure to be fallacious. The question is, what characters are we to go by ? The answer to this question is clear enough ; but to apply the method indicated by the proper answer is far from being so easy. We may take for granted the fact (as it has been rightly termed) of Evolution. Whatever may be the truth of the various theories, such as Natural Selection, which have been advanced as explanatory of evolution, there has been since the beginning of time as we read it in the rocks, a continual series of changes in animals. As already intimated we can trace pedigrees in a few cases with certainty ; in other cases intermediate steps have been lost or not discovered, but the broad outlines are left. Thus amphibians appear before reptiles, and reptiles before mammals. From one or other of these groups mammals must have arisen. It is not at present agreed, the evidence is not yet conclusive on the matter, from which group mammals have arisen ; but it is clear that marked traces of characters which are not distinc-

tively mammalian but appertain to the lower lying amphibians and reptiles, are important indications of the grade of the mammal concerned. Now perhaps no two mammals are more diverse in outward appearance and even in many anatomical details than the spiny ant-eater of Australia, and the duck-billed platypus of the same continent.

The one is spiny, toothless, long-snouted, long-tongued; the other furry, "duck-billed," web-footed; their skeletons and internal organs differ widely, and yet in both of these creatures the young are hatched from large eggs with much yolk, and there is no connexion between the young and the mother, the eggs leaving the body *as* eggs. Furthermore, there is a peculiar vein, or traces of it, which is quite like a vein found in the lower vertebrata, but not represented in the higher mammals, and the structure of the heart shows an analogous state of affairs. All these points link the Monotremata, as the order comprising these the only two existent types of the order is called, together; they have been arrested, as it were, before they have completely thrown off the characters of the amphibio-reptile from which the mammalia have in course of time been evolved. We must therefore clearly set apart those two forms into a group by themselves. The remaining mammals, the vast majority of course, can hardly be sorted into an ascending series, getting less and less reptilian. Palæontology, moreover, while explicit as to the relationships of certain groups, is at present cloudy as to the derivation of the higher mammals, or Eutheria as they have been termed, from the Monotremata, the only surviving members of the early mammals, or Prototheria. All the Eutheria contrast with the Prototheria in having minute eggs which are not "laid," but develop inside the body of the parent, and come to be attached to the tissues of the mother, deriving

their nutriment therefrom. Nor can it be said that any other fundamental character of equal value differentiates the many orders which constitute the Eutheria. In earliness of appearance it is plain that the marsupials lead the way ; but it is not plain as yet that they are really primitive mammals as compared with the rest of the Eutheria. The remains as yet gathered from earlier rocks is so small that it would be rash to invoke the aid of Palæontology in settling this matter. In the meantime we can separate them off as a very well marked group ; and it is fair to consider that they represent an offshoot of a more typically Eutherian stock. The marsupials are more fully treated of later. There remain those mammals which have not got any claims at all to be of very great antiquity ; the existing creatures are separated into the following groups, which are generally spoken of as "Orders," viz. *Primates*, i.e. man, monkeys, and lemurs, whose characters are fully entered into below ; Bats or *Chiroptera*, which stands apart from all other mammals in having the fingers of the hand enormously elongated and supporting, umbrella-like, a thin membrane also attached to the body which serves as a wing.

The greater part of the bats are night-flying and insect-feeding creatures ; but a few, known on that account as "fruit bats," feed upon fruit. Of these latter bats there are usually a number of specimens on view at the Zoological Gardens. The Insectivora, or moles, hedgehogs, shrews, etc., are dealt with on a subsequent page ; so too are the Carnivora, the flesh-feeding and predaceous cats, dogs, bears, and seals. The Ungulates or hoofed mammals, are the deer, camels, rhinoceroses, elephant, horse, cow, sheep, and the like ; their characters are pointed out in due course. Of the orders Sirenia (manatee, dugong) Rodentia (rats, mice, porcupines, etc.), Edentata (sloths, ant-bears), the principal

characters are put before the reader in the course of this book. The only remaining order of existing mammal is that of the whales, the Cetacea, of which the common porpoise is the only type that has ever been exhibited at the Zoological Gardens. We shall therefore omit them in the present book.

§ Order Primates: Monkeys and Man

It is not our business here to enter into psychological distinctions between man and the apes. That department of enquiry is not zoology at all. What we are concerned with is to show that man and apes are not separable into diverse orders among the mammalia, although it may be permissible to assign to man a special family for his own enjoyment. Even this amount of separation might be objected to, and on grounds by no means trivial. Let us consider what are precisely the differences which mark out man as distinct from the highest apes, the orang, gorilla, and chimpanzee. Prof. Haeckel has pointed out that four characters, and four only, define men. Firstly the erect gait, secondly the slight structural modifications which have rendered necessary or are rendered necessary by this upright posture, thirdly the faculty of speech; and, lastly, the faculty of reason. With the two latter characters we have nothing to do here; they are outside the province of the zoologist. As to the former, the erect attitude of body is at least approached in the anthropoid apes; the gibbon will run for some distance upon its legs, and the gorilla shows a distinct difference from the chimpanzee, otherwise so nearly akin, by certain modifications connected with its less aboreal life. No ape, however, perpetually walks upon its hind limbs only; it is to man alone that nature "os sublime dedit vultusque attollere ad astra."

Connected with this carriage of the body are differences in the proportions of the limbs, the existence of a heel, and the loss of the ape-like great toe, which serves in them the functions of a thumb. A man in fact is short armed, firmly plantigrade, with a pronounced heel, and with no " thumb " on his feet. Besides, there are minor differences which we may properly insist upon as distinctive of man. Not, however, all the commonly supposed differences. For example, man is not a hairless mammal at all. It is true that the hairy covering is not obvious everywhere, as it is in apes ; but an investigation with the microscope will show that the hair follicles exist in reality where the hairs themselves are so fine as to escape, or almost to escape, detection. It is quite possible, moreover, that the wearing of clothes, which is doubtless an exceedingly ancient habit of man, is responsible for the not great development of hair. The smooth and unridged skull is a human attribute, and so is the proportionately larger size of the brain than in the Anthropoid apes. It must be remembered, however, that in the smaller monkeys the brain is sometimes proportionately large.

The S-like curvature of the spine is a human characteristic in so far as it is more perfectly developed in man than in apes ; and there are, in short, a number of other small characters which are merely differences of degree and not of kind from the corresponding structures in the monkeys.

This group, Primates, which must therefore include man, is easy enough to distinguish from groups lying lower in the series if we extend it so as to include the lemurs.

The group is an eminently arboreal one ; in fact, the exceptions to this are but few. Co-related with this general mode of life are the opposable thumb and great toe, a character which is almost universal in the order,

and which is not found in other mammals. It is to be noted further that, again with but few exceptions, the Primates have five fingers and five toes—the reduction of digits so common in other groups, especially the Ungulata, not being met with here to the extent of more than one digit. Again, the Primates are hairy creatures, and are never spiny or naked. The nails upon the fingers and toes are to a considerable extent, or even entirely, flat, and as a rule not claw-like. There are, however, exceptions in the case of some digits in some Primates. The Primates have canine teeth, with the sole exception of the aberrant and remarkable Madgascar lemur *Chiromys*, the aye-aye, which has furthermore huge incisors and simulates in other ways a rodent animal, with which group it was in fact at one time confounded. It is at times to be found in the collection at the Zoo.

It is plainly possible to divide the Primates into two divisions, viz. the Anthropoidea, or monkeys and man, and the Lemuroidea, or lemurs. The latter group connects the higher group with such lying lower in the scale as the Insectivora. They lack the literally straightforward look of the Anthropoidea ; for the eye sockets in the skull are not so distinctly marked off for the reception of the eyes and the eyes only, as in apes and man. Their features, too, are foxy, and their brain is at a lower level than that of the higher Primates. Intermediate types, however, lately discovered in Madagascar, and of extinct forms, forbid a complete separation of the lemurs and monkeys.

§ Monkeys and Apes. The Sub-order Anthropoidea

The distinguishing features of the higher Primates, the monkeys, have been already dwelt upon. It remains to consider the group a little further, in itself,

and not so much as contrasting with the lower lying Lemuroidea. It is a noteworthy fact about the monkey tribe that, numerous and widespread as are its representatives, there are but slight variations from one easily definable type. There is no creature belonging to this assemblage that is not at once referable to its proper place in the system by the least experienced of those accustomed to observe.

The singularly monotonous type of structure prevalent in the Anthropoidea contrasts with the diversity shown by the Carnivora, the Ungulata, the Rodentia, the Marsupials, and indeed nearly all the orders and groups of the mammalia, including even the lemurs, the second sub-order of the Primates. This may be associated with an equal uniformity in way of life. Monkeys are essentially a climbing race, and are vegetarians tempered by slightly carnivorous habits. It may also be associated with a high position in the series of mammals. Those orders which come nearer to the base of the series, which are, therefore, nearer to the primitive mammal, have clearly greater capacities for variation than the thinnest topmost twigs of the mammalian tree of life, whose characters are, therefore, more fixed. This suggestion may be both checked and enforced by the consideration that monkeys are a modern race, and that, may be, they have not yet had time to throw out feelers in various directions, some destined to produce a new race of descendants, others more comparable to sterile side branches. Uniform though the internal as well as external anatomy of the monkey tribe is, it is yet possible to sort them out into three divisions, which can be detected by internal as well as external characters, or sometimes by the former only.

Broadly speaking, the mammalian inhabitants of South America differ from much their nearest allies

in the continents of the old world. This is seen also in the monkeys. The American monkeys have the nostrils wide apart with a septum between them ; the tail, when present, is often, indeed nearly always, prehensile, and serves the purpose, as it has been termed, of a fifth hand, to enable its possessor to grasp additionally on to the branch of a tree. It is not clear that the monkeys of America are deafer than their allies of Asia and Africa ; but it is an anatomical fact that the former have not the little spout-like bone for conveying sound to the internal part of the ear devoted to the reception and analysis of sound waves, which is present in the Catarrhines. The visitor to the Zoo will note the eager way in which monkeys will often cram nuts and other proffered food into their cheeks to be disgorged later, and eaten at leisure ; but it will be noted that no monkey hailing from the American continent ever does this ; there are indeed in the Platyrrhines no cheek pouches at all. Nor do those gaudy red callosities, so characteristic of baboons and other apes of the Old World, ever deck or adorn the monkeys of America.

The Platyrrhine apes of America consist of two main groups, which are themselves further apart than are any two forms among the apes of the Old World, not excepting such apparent contrasts as the gorilla and the bonnet monkey. In the tiny little marmosets the tail is not prehensile, and the hand is, so to speak, not a hand but a paw. The thumb is not opposable to the other fingers, and the nails upon those fingers are rather claws than nails ; but these characteristics are obviously so far not ape-like, and ally the marmosets to animals lower in the series than apes. These points can be readily verified by the visitor.

The apes of the Old World are usually divided into two great groups, the Catarrhines and the Simiidæ, or an-

thropoid apes. But both of these divisions have the catarrhine physiognomy with narrow nostrils, and possess the little spout-like process spoken of as absent in the Platyrrhines. The Catarrhines pure and simple (excluding, that is to say, the anthropoids) never have a prehensile tail, and are occasionally without a tail at all; they have, as a rule, cheek pouches. They have only thirty-two teeth, while the Platyrrhines have thirty-six, with the exception of the marmosets; these however, have the thirty-two, which they possess in common with the old Catarrhines, rather differently arranged. Instead of there being two premolars and three molars on each side of each jaw, there are three premolars and two molars in the marmosets.

The great man-like apes have no tail; they have not any cheek pouches; finally, they possess in common with man the doubtful advantage of a vermiform appendix, a structure which Nature has fortunately, as it appears for them, denied to any other group of monkeys. They have, however, the same thirty-two teeth of the Catarrhines.

The Chimpanzee and the Gorilla

It may seem unnecessary to bracket together these two anthropoid apes. But the fact is that they have been not unfrequently mistaken the one for the other; and in any case they are near akin, and both are inhabitants of tropical Africa. We shall see, however, presently that there is no particular reason for confusing them, at any rate in the living condition. As to the chimpanzee, the difficulty in writing about it is to limit the account. Probably no animal, at any rate of late years, has been so much written about. Paragraphs and articles relating to the defunct Sally of the Zoo would fill many goodly volumes; while the more recent

favourite of the public, "Consul," has achieved much literary notoriety. The chimpanzee is perhaps the only anthropoid ape of which specimens are pretty certain to be found in the New Ape House. Probably two or three will be on view to the reader of these lines. But the gorilla is much less patient in captivity besides being more hard to obtain. There have, in fact, been only five examples of this fierce anthropoid ever exhibited in Regent's Park. The first specimen of the chimpanzee ever exhibited appears to have been acquired so long ago as 1836. This chimpanzee created great excitement in London, and evoked verses from that excellent rhymester and lampoonist, Theodore Hook. "The folks in town," he wrote, "are nearly wild—

> To go and see the monkey child,
> In gardens of Zoology,
> Whose proper name is Chimpanzee.
> To keep this baby free from hurt,
> He's dressed in a cap and Guernsey shirt;
> They've got him a nurse and he sits on her knee,
> And she calls him her Tommy Chimpanzee.

Hook (Tory, it will be remembered) goes on to describe visits paid to this celebrity by Lord John Palmerston, and ministers generally. "Sally" who succeeded, *longo intervallo* in point of time but not popularity, caused almost as great a furore as did the elephant Jumbo on his departure. This latter ape, in fact, illustrated excellently well one of the main differences between the gorilla and the chimpanzee. The chimpanzee is playful, even malicious, and quite teachable. The gorilla is sullen, gloomy, ferocious, and quite untamable. Anyone who has ever seen a gorilla at the Zoo will realize this intellectual difference between the two men monkeys. The gorilla, as du Chaillu truly said, though he was contradicted by persons not knowing much about the matter, beats its breast when angry.

The chimpanzee has never been observed to indulge in this expression of the emotions. To call the gorilla untamable is not perhaps quite fair to the gorilla. These beasts live so short a time in captivity, so far as experiments have shown, that there has been but little time to put the belief to the proof. The gorilla possesses the requisite physical basis for educatability. The brain is on the average, says Dr. Keith, larger than that of the chimpanzee, though the highest records among the chimpanzees beat the lowest record among gorillas. As to its complex structure, the brain of both differs in no essentials from the human brain, and the ancient controversy about the "hippopotamus minor," as Kingsley called it, has been laid to rest long since. Blackness of visage does not distinguish the gorilla, as was once thought when every chimpanzee with a black face was gravely suspected of being a gorilla or the result of a mésalliance between the one and the other. But the smaller and more refined-looking ear of the gorilla, somewhat like that of the eastern Anthropoid, the orang-utan, contrasts with the big ears of the chimpanzee, and is on the whole an external mark of difference between them. Any one can observe for himself that the human ear is liable to great variations, and some persons are chimpanzee-like, while others come nearer to the gorilla in this feature. The general structure of the two apes leads to the conclusion that the gorilla is the older type, and the chimpanzee the more modified. But this is not wholly true, for the chimpanzee has retained the undoubtedly more primitive aboreal mode of life to a fuller degree than the gorilla, whose likenesses in this respect to man are not so much an indication of special relationship as a parallel divergence from the normal, so far as apes are concerned. These adaptations to an arboreal life have left their mark upon the outward appearance of both anthropoids.

The hand of the chimpanzee is long and thin; it is in fact convertible into a hook for hanging on to branches; in the gorilla the hand is shorter and the fingers are webbed at the base as in the human hand, to which it bears considerable resemblance. It has been well said that if the dictum, "Ex pede Herculem" is true, so is the further evolution of that observation, "Ex calce hominem." Now the gorilla has a better heel than the chimpanzee; and this again is associated with the frequent travels of that animal upon the ground in a more or less walking posture. Certain muscles tell the same tale. Indeed we may fairly come to the conclusion that the gorilla is much nearer to that mysterious and at present totally unknown creature, which first crossed the narrow line dividing the ape from the man, than is the chimpanzee. Whether the famous *Pithecanthropus erectus* of Dubois, whose bony fragments were found in Java, is the "missing link" or not, cannot be decided; but it is unquestionably a suitable candidate for that position so far as the top of the skull enables us to form a judgment. Chimpanzees have been divided into more than one kind, and such names as *Anthropopithecus calvus*, *aubryi*, *kulukamba*, have been given to these varieties. The variety which has the most claim to be regarded as an independent form is that represented by the notorious Sally, The species, if species it be, was brought home by du Chaillu, and that specimen is now in the British Museum at South Kensington. Sally's stuffed skin adorns Mr. Rothschild's museum at Tring, while her brain reposes in the University Museum at Oxford. The gorilla, too, has been lately subdivided. In fact, it used to be thought that both apes were limited in range to the gloomy forests of the Gaboon. But it is now well known, thanks to Emin Pasha and others, that the chimpanzee goes much farther east, and so in all pro-

bability does the gorilla. It is possible, therefore, that we may believe in at any rate racial varieties of these apes. The gorilla has got its name under false pretences. It is certainly not the ape seen to pick up and hurl stones by the Carthaginian Hanno, author of the *Periplous*. That creature was probably a baboon, which does live in herds and can throw stones.

The Orang Utan

The orang, whose scientific name is *Simia satyrus*, and whose vernacular Malayan name generally used by us signifies Man of the Woods, is, like the gibbon, an Asiatic kind of anthropoid ape. It is Bornean and Sumatran in range; and in those great islands of the East frequents steamy forests. The orang is a large and heavily built ape, with a melancholy countenance, and a very protuberant abdomen, a feature of all the Anthropoids except the specially athletic gibbons. Its tawny yellow colour is well known, and it has been pointed out that while the black chimpanzee and gorilla share their forests with equally black man, the yellow Malay pursues the yellow orang.

As with the anthropoid apes generally, the examples of orangs exhibited at the Zoo are invariably young creatures, and thus do not show all the salient characters of the huge ape of Borneo. For in the fully developed male the face is broadened by a callous expansion at the sides, which is eminently characteristic, and gives to the ape a remarkable look distinctive of it. The orang is more peaceable than its relatives in Africa, and is said to rarely dispute matters with man. Those at the Zoo seem to have always a friendly attitude of mind, which seems to fit in with their slow ways and somewhat sad demeanour. At times, however, the orang can lose its temper; Mr. Wallace reports a continued

attack made by an orang upon a tree, consisting of showers of hard fruits with which it assiduously pelted its pursuers. Structurally it may be noted that the orang differs from the other anthropoid apes in its small and delicately shaped ears, much like those of the gorilla, in the small size of, and absence of a nail upon, the great toe. It is curious, too, that this ape has its femur loose in the socket by reason of the absence of a ligament binding that bone to the hip bone. This may account for its cautious and deliberate movements when moving from branch to branch of its native trees. This ape builds a kind of nest in trees, which is not a permanent dwelling place, but merely a place of temporary sojourn. It is built of a number of branches laid together and covered with leaves, and is about a yard and a half across.

The Hoolock

The Hoolock and its immediate relatives, the other members of the genus *Hylobates*, or gibbons, stand a little below the chimpanzee, the gorilla, and the orang, which complete the list of living anthropoid apes. In intelligence they are not inferior at all; indeed they seem to possess the greater sharpness often incidental to small size. But structurally the gibbons form a link, not very perfect, with the lower standing Catarrhine monkeys.

To begin with, there are in these anthropoids at least traces of the ischial callosities so characteristic of the Old World monkeys. The canine teeth, large enough it is true in the old male gorilla, are still larger proportionately in the Hoolock, and thus more closely approach such teeth in lower mammals. The brain is rather simpler, but perhaps this is merely a matter of smaller size than of affinity to the macaques and such like,

The tail is wanting, as in the highest apes and in man ; and the vermiform appendix is present as in the same. The lower monkeys generally (but not always) possess a tail. So much then for the chief points in the inward and outward structure of the Hoolock and its congeners which help to fix its place in the Simian system. The hoolock, or at least some form of gibbon, is almost sure to be on view in the New Ape House at any given time. It will probably also appeal to another sense, that of hearing ; for this gibbon, like others, has a piercing though not unpleasant voice by means of which it utters a series of cries which have been variously rendered "Hooloo" and "Whoko." It prefers climbing to walking ; and when it does walk, which in nature appears to be practically never, it walks on two legs as a rule, and divaricates its big toe like unbooted man. Its extraordinarily long arms are used in this method of progression as balancing poles to aid in its waddling run. Placed on a tree the gibbon has no equal among the monkey tribe. It swings from bough to bough "with the unerring accuracy of a finished trapeze performer." It is an odd thing that this gibbon at any rate cannot swim, and naturally, therefore, never takes to the water on its own account. Monkeys, as a rule, can, and do voluntarily, set out to swim, crossing rivers in their marches, but the gibbon never ; and thus its range is often limited by great rivers such as the Irrawaddy. In this dislike of water it plainly resembles man, who is almost the only other creature that cannot swim by the light of nature, but requires teaching. The specimens of gibbon that have been on view at the Zoo are numerous, and are of many species. Quite recently there was on view an example of the very rare Hainan gibbon, an ape which frequents the island of Hainan, its easterly limit as a genus. Another rarity is the Siamang, a gibbon

GIBBON

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in which two of the toes are united by a web ; of this gibbon there have been examples at the Zoo, and may be at the present moment. The hoolock is easily tamed, and is not as a rule very vicious. A female lately inhabiting the ape house showed a positive dislike to her own sex in the human species, but put up with the attentions of men. In India the animal appears to be often tamed, and will reside in a " compound " for years. Under these circumstances, Dr. Candler tells us, it seldom uses its voice, the need for this expression of opinion having departed with the rest of the herd. At the Zoo, on the other hand, the gibbon makes vocal the ape house, stimulated thereto, it may be surmised, by adjacent chimpanzees, and by the conversation of the keeper and of visitors.

The Chacma Baboon.

This is a necessary abbreviation of the Hottentot word " T'chatikamma," which is really not pronounceable by us, and is, moreover, a trifle difficult of correct spelling. The name refers to the baboon, *Papio porcarius*, which with twelve other species inhabits Africa. The chacma, and baboons generally, lie at the base of the Catarrhine series, or Old World apes. They have the cheek pouches, the downward looking and approximated nostrils, and the thirty-two teeth, disposed as in man, and the non-prehensile tails of that division of apes. The baboons differ from other Catarrhines by their " very dog-like face," by the rather swollen muzzle, and by the large size of the posterior callosities. The males have also particularly large canine teeth. The tail is short. Our chacma, which is always to be seen at the Zoo, and has recently been placed outside instead of inside the stuffy monkey house, lives in the South of Africa in troops up to about 100 in number. This

marauding band of apes is guarded by a few old males who form a rear guard. The chacma prefers rocky and stony localities, and is mainly a ground dweller; but it can climb trees with skill. When running along this and all species of the lower apes tread on the palms of their hands, in this differing from the anthropoid apes who double up their hands, and progress upon the knuckles. The chacma can go at a good pace when put to it; but it is a ferocious beast, and will stand up to a fight if attacked. Its chief enemy, who is the leopard, is sometimes severely mauled by an old fellow whose canine teeth and strength of muscle are hardly inferior to those of the aggressor. Whether the chacma throws stones or not, it is plain that many baboons do, and indeed in this they resemble some other monkeys who pelt the stranger with the local equivalent of the "'arf a brick" of Aryan civilization. Ferocious though the elderly baboon may be, the young are more engaging in their disposition. The traveller le Vaillant indeed speaks well of the race. A pet chacma was of considerable use to him as a taster, such as were employed by mediæval monarchs for their protection. When a dubious, but good-looking root was discovered, the chacma was encouraged to bite it; and if it refused with "every symptom of disgust," the root was not entered on the menu. The chacma is most omnivorous; it eats anything and everything, from the leaves of the prickly pear (especially, it is stated, the most prickly leaves!) up to insects. It will descend in its hordes upon orchards and fields, and has lately caught the trick, like the kea in New Zealand, of tearing open young lambs for the sake of the curdled milk in their stomachs. At least the baboon prefers the milk while the kea is more thorough and less specialized in his appetites.

This baboon is diurnal, retiring to rest at night in the most respectable middle-class fashion, its slumbers

BABOON

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being guarded by sentinels which are posted round its retreats. The voice of the baboon, like the voices of other creatures, has been variously put into descriptive language. An eminent naturalist, clearly with an anti-Teutonic bias, compared it to the German word "Hoch." Various human actions have been ascribed to baboons. It seems probable that they were the origin of the story of the gorillas of Hanno, who referred to them as stone-throwing and living in throngs. When annoyed, or in an offensive mood, this baboon will open its mouth and as it were yawn at a neighbouring baboon; it is suggested that this yawn is not so much ennui as a desire to prove to the other the length and sharpness of its canines. When still more angry the ape will smite the ground with its hand like an argumentative man with his perceptions and feelings heightened by alcohol.

The sociable though ferocious and omnivorous mandrill, with its blue-ridged nose, is another member of the genus often represented at the Zoo. The most aberrant baboon is the Celebesian *Cynopithecus niger*, which is the only Eastern baboon; it is black in hue, smallish in size (as compared with other baboons) and milder in disposition than are the large dog-faced apes of Africa.

The Gibraltar Ape

This ape, also known as the Barbary ape, *Macacus inuus*, is the only monkey that occurs now in Europe; and, as is well known, it is confined to the rock of Gibraltar, which it haunts in very modest numbers. At one time so unfavourable were natural circumstances, or so inveterate the dislike of the inhabitants, that the numbers sank to so low an ebb as three individuals. But in 1893 the Governor of Gibraltar ascertained, and

communicated to the Zoological Society, the fact that no less than thirty of these tailless apes had been seen in one herd. The interest of the presence of these apes in Europe seems on the whole to have been allowed to overbalance the objections felt towards them on account of their depredations in gardens. But it is not quite certain how far the interest is a genuine one, that is to say, how far the *Macacus inuus* is a really indigenous inhabitant of African Spain, and whether it was not at one time deliberately introduced there and allowed to run wild. Be this as it may, the ape proved capable of establishing itself in the more inaccessible parts of "the Rock." *Macacus inuus* belongs to a genus of monkeys, which is, like the baboon, a member of the Catarrhine subdivision. So that it is unnecessary to recapitulate the characters which, being a Catarrhine, it shares with the baboon. These monkeys are, with the exception of the species which we are here considering, entirely Asiatic in range; and many members of the genus are familiar enough, for a large assortment is always on view in the monkey house and the outside monkey cages at the Zoo. The Gibraltar monkey is also exceptional in that it has no tail, though in many of its allies—for instance in the Tcheli monkey, that thick-furred inhabitant of the Yung Ling mountains of Northern China—the tail is plainly on the way towards disappearance. On the other hand the common bonnet monkey and Rhesus monkey have longish tails. There are altogether some fifteen or sixteen species of macaques. The Barbary or Gibraltar ape has a certain historical interest in that it appears to have been the monkey dissected and studied by Galen the Greek physician.

PREHENSILITY OF TAIL

The Diana Monkey

The macaques of Asia are represented in Africa by a kindred pair of genera of monkeys, known technically and respectively as *Cercopithecus* and *Cercocebus*, and in pseudo-vernacular, as Guenons and Mangabeys. They have always long tails, which, as has been noted, the macaques have not always ; and the mangabeys possess no laryngeal pouch capable of inflation such as is to be found in the macaques. The Cercopitheci are apt to run to bright spots of colour about the nose, and their fur generally is more gaily coloured than in the sombre macaques. The Diana monkey, *Cercopithecus diana*, is as good a type as any other of this extensive genus, which contains more than forty species. This monkey like some others of its congeners is bearded, white bearded, and there is a good deal of bright chestnut or orange colour about the body. It is like other guenons essentially tree dwelling and social, moving about in herds ; like most monkeys it is affable when young, but morose and treacherous when older. Like all others of the apes of the Old World its tail cannot grasp the branches which it traverses in the fashion so convenient to most of the monkeys of America ; and that there should be this distinction is one of the remarkable facts about monkeys. Why a prehensile tail should have been developed in one half of the globe and not in the other in creatures which lead for all practical purposes identical lives, and are plainly most closely allied, is a mystery apparently insoluble. Evolution seems so to speak to have gone out of its way in denying this favour, which it has granted so widely and to so many and such varied types of animals. e.g. marsupials, lizards, snakes, etc., etc. Anyhow the long tail of the Diana monkey and its immediate allies is at best a balancing pole to secure a safe transit across

a difficult part of a tree. The beard of the Diana monkey is not a mark of sex. It is an adornment of the female as well as of the male. It is stated that the monkey is apparently proud and careful of the well-being of this ornament. When drinking it will carefully hold it aside. This black-faced West African monkey is one of the species with which the Zoo is sure to be furnished. The visitor will also find many of the remaining forty or so species of *Cercopithecus*.

The Langur or Hanuman

The Holy Apes, genus *Semnopithecus*, to one species of which, *S. entellus*, the name Hanuman is applied, are collectively known as Langurs, and inhabit the East, including the continent of India. They differ from the macaques of the same region and from the Cercocebi and Cercopitheci of Africa in having no cheek pouches in which to store superfluous food for subsequent mastication; they always have a long tail, which the macaques, as has been remarked, do not always possess, and they have a large and complex stomach instead of the small and human-like stomach of the macaques and their allies of Africa. They attain also to a fair size, and a species of *Rhinopithecus* (hardly distinguished in reality from *Semnopithecus*, except by its nose) is the largest existing monkey after the great Anthropoids. The name Holy Ape implies the fact that many of these monkeys are reverenced by the native, and thus enjoy immunity from persecution; this freedom from interference leads them to such lengths that the species which we are considering here more especially, the Indian Hanuman, visits and pilfers from shops with impunity and takes open exercise upon the roofs of houses. Like so many apes, the Hanuman is sociable, and moves about in clans, which occasionally meet other

clans, and do fierce battle ; in these combats discipline and co-operation are apparent, an interesting foreshadowing of human ways. The Hanuman is exceedingly agile, and will bound from branch to branch, sometimes attaining to a leap of 20 to 30 feet measured horizontally, but rendered easier by a corresponding drop of 40 to 50 feet. In spite of this astounding activity, F. Cuvier stigmatized the groups as " slow monkeys " ! The Hanuman shares with man a detestation and fear of the tiger ; a group or troupe of these monkeys will follow a tiger, making Simian remarks, and plainly indicating its position to the following hunters. In Siam it is held among various native traditions that the Semnopitheci are dangerous apes to the human kind ; that they play the part of vampires, and suck the blood of sleeping men in the forests. But there is no truth in this belief, the Semnopitheci being, as a matter of fact, vegetarian in the extreme even for a monkey. No insects and grubs of various kinds, no eggs and young birds enter their purely leafy, fruit, and grain diet. In captivity these animals are described as sedate and indolent till old age supervenes, which induces a more truculent demeanour. The nosed ape, *Rhinopithecus*, with a little upturned and pointed nose, not snout, has been referred to. There is another form known as *Nasalis larvatus*, which has also a longish nose quite human in sharpness and length. These forms are the only monkeys with anything comparable to the human nose.

The Guereza

It is interesting to note that while the macaques of the East are represented in Africa by the closely allied Guenons and Mangabeys, the Semnopitheci of the East are also represented in Africa by a type of monkey closely allied to themselves but forming a distinct

genus, viz. *Colobus*. This genus of monkeys has the same absence of cheek pouches, and the same sacculated stomach, but it has nearly lost the thumb, which gives it a certain likeness to some monkeys of the New World ; this likeness is a trifle increased by the rather broader nostrils shown in these monkeys, a broadness which suggests the Platyrrhine type rather than the Old World Catarrhine. Nevertheless, in all other particulars the Colobi or Guerezas do not approach the monkeys of America, but clearly range themselves alongside of the Oriental Holy Apes. It is an odd coincidence, in view of this now unquestioned affinity, that in Nigeria *Colobus guereza* is known to the natives by the name of "Maclam." The coincidence lies in the fact that this word means also a Mohammedan priest in the Haussa language. The idea of sanctity thus attaches itself to *Colobus* as well as to its near relative *Semnopithecus*. The black and white excessively long-haired skin of more than one species of *Colobus* is largely used for ornament, not merely in its native Africa by a warrior, but by peaceful persons in this country ; those long and coarse-haired black muffs are, or used to be, the product of the skin of this monkey. There is a legend to the effect that the *Colobus*, when wounded, knowing full well the value of its skin, deliberately tears it with its teeth, so that it shall not come into the possession of its slayer. These apes, like the Holy Apes, go up high upon mountains in Africa ; and a species from Ruwenzori has the peculiarity of having longer hair than any other species, a peculiarity which is possibly correlated with its Alpine existence. It is said that the bright black and white hues of *Colobus* do not invariably, as might be expected, render the monkey a conspicuous object, since hopping from branch to branch the contrast of colours is in harmony with dark tree trunks garlanded with white and grey lichens. It is not very often that members

of this genus are to be found among the inhabitants of the monkey house.

Capuchin Monkey

It is not necessary to go to the Zoological Gardens to make oneself acquainted with the capuchins; for they are frequently, more frequently than any other kind of monkey, the companion of the peripatetic organ-grinder, and their mild, inquisitive faces and chirruping sounds must be well known to most persons. There is a great variety of these monkeys, which may be regarded as quite the typical Platyrrhine monkeys. Their round face and but slightly projecting muzzle give them a human appearance, which is not attained to by the monkeys of the Old World so thoroughly. Their tails are not quite so perfectly prehensile as in many of the American monkeys—in the Spider monkey, for instance. They are also docile and gentle, though it is doubtful whether this can be honestly considered to be any grounds for a likeness to man. The capuchins are always abundantly on view at the Zoo, and as a rule several species are to be seen, though the limits of species in this genus of Platyrrhines is rather a matter for further study than for the present and dogmatic statement. Some eighteen have been allowed. The capuchins are determined insect eaters, as well as devourers of fruits; they rob nests and eat up eggs and nestlings alike. At the Zoo they have an engaging way of holding out their hands for gifts, and this action is accompanied by a little plaintive whistling. They appear to be on good terms with each other as well as with the public. Tree-bred creatures as they are, the capuchins are naturally expert climbers and leapers; huge distances are traversed by them in bounding from branch to branch. A jump downwards of fifty feet

appears, according to the traveller Bates, to be easily accomplished by *Cebus albifrons*. Their agility can be readily studied at the Zoo, though the limited range for leaping and climbing renders it a little difficult to compare, and award the palm satisfactorily.

The general characters of the Platyrrhine form of monkey can be as well studied in these monkeys as in any other. The widely separated forwardly and not downwardly directed nostrils, the prehensile tail, are all obvious ; but it will be hardly possible to note in the living monkey the thirty-six teeth, which are four in excess of the teeth of the monkeys of the Old World, including man.

Spider Monkey

There are several kinds of spider monkey, perhaps ten. But they all agree in representing the Platyrrhine characters, or at least one of them, in a quite exaggerated fashion. The prehensile tail is eminently prehensile, its tip naked beneath to afford a securer clutch ; it is never at rest even when not in use as a " fifth hand " ; perpetually does it explore the objects lying above the monkey's back, like the restless tentacle of an anemone. The name spider monkey refers to the straddling and spider-like appearance presented when one of these monkeys is grasping various objects with hands, feet, and tail widely divaricated and radiating from the small body in the centre. The spider monkeys of the New World suggest the gibbons of the Old. In many monkeys the thumb has become somewhat rudimentary ; in *Ateles*, as the spider money genus is termed, it has often disappeared. But the reason for this, or at least a reasonableness in the fact, is evidenced when it is considered that the hand of these and many monkeys is of the nature of a hook to grasp temporarily a branch

and to allow of a ready loosening of the grip ; an opposable thumb does not aid in this manœuvre. The Coaitas, as the native American name of the monkeys runs, are peaceful in disposition, but eminently thievish in habit, and therefore less suitable as pets than might be presumed from the great numbers that are kept as pets in Central America. On the other hand, there is at least one spider monkey which has been described as very fierce. The spider monkey, or at least *a* spider monkey, is roasted and eaten ; as it presents, when dressed for the table, a horrible resemblance to a black baby, it is usual to lessen this likeness by cutting off the head and hands. The flavour of the flesh is beefy, not veal-like. The hint of cannibalism involved in dining off monkey is tempered by the fact that the creatures are very largely, but not absolutely, vegetarian in habit. Von Humboldt suggested that cannibalism may have commenced in an evolutionary way with this " simiophagy," or at least that it may have contributed to lessen the initial shock which would be caused by serving up man as a *pièce de resistance* at a banquet. Probably, however, cannibalism is not a single phenomenon ; there are, we are inclined to think, two kinds ; the one a religious ceremony, the other purely gastronomic.

The Howler

The howling monkeys are Platyrrhine, and thus necessarily South American monkeys which have been placed in the genus *Mycetes*, or, as it is sometimes called, *Alouatta*, a barbarous word, which is, however, older than the more correct *Mycetes*. They are called howlers not merely because it is their name, as in so many creatures with non-descriptive appellations, but because they do howl and awake the echoes of American

forests by night. So far-carrying is the howl, that the late Mr. Salvin found, by calculating the time that it took him to traverse a patch of forest from where the note first broke upon his ears to the base of the tree whereon the Mycetes howled, i.e. one hour, that the voice must have travelled about two miles. The howling is largely assisted by the modification of the throat bone, the hyoid of anatomists, into a deep cup which is a resonator ; in other characters the howler is quite a typical Platyrrhine ; its distinctive marks are that it has a naked face and usually a beard and a well developed thumb. The beard and face produce a repulsive look, and for some reason or other, when a beast is ill-looking, which is not infrequent, naturalists often dwell in an almost malignant way upon its ugliness. The howler justifies the uncomeliness of its features by a bad and sinful disposition, and, furthermore, by a low intelligence which is stereotyped in the simple and not complexly folded brain. The howling seems to be a means of intimidation ; and it is a moot point whether like cats they howl in concert, or whether it is merely a big male who gives vent in this way to defiance of neighbouring males. In any case, those who have heard it compare the note to the tempest howling through rocky caverns, and in this case justly add that " it is a noise so unearthly that, heard unexpectedly for the first time, it would fill the mind with the most melancholy and fearful foreboding." The American forest is apt to harbour or to produce such gloomy noises. There is, however, another and a brighter side to the howler ; it appears to be good for food above all monkeys.

CHAPTER III

The Lemurs : Sub-order Lemuroidea

THESE nocturnal creatures, which have got their name from that way of life, stand unquestionably at a lower level than the apes, whose near relations they nevertheless must be regarded as being. Among themselves they are somewhat more diverse of habit than the monkeys, and show in consequence rather more differences of structure and appearance. The rodent-like *Chiromys* would hardly be referred to the same group of creatures as the tiny little "Smith's dwarf lemur" (*Microcebus smithi*) or the ambling and quadrupedal black and white ruffed lemur (*Lemur varius*), by any one not conversant with anatomy, and without the power of making just inferences as to affinity. All lemurs, however, have hand-like feet with an opposable great toe exactly comparable to the thumb of the hand.

The most remarkable fact about the lemurs is in reality their extraordinary geographical distribution in the world. The vast majority of them are absolutely confined to the great island of Madagascar, where they form the most important element in the vertebrate fauna. A few live in Africa, and still fewer in the east of Asia. No kind of lemur is common to any two of these three tracts of country which they inhabit. At

the Zoo a good many species are as a rule to be seen. The true lemurs are commonly found represented by several species, such as the black lemur (*Lemur macaco*), and the crowned lemur, which mainly differ from each other in colour. The African galagos, with long and naked ears and apparently a keener sense of hearing than the other forms, are generally to be seen. Some of the smaller Madagascar species, such as Coquerel's lemur (*Chirogaleus coquerali*) and Smith's dwarf lemur, are often on view, while the West African potto (*Perodicticus potto*), tailless and very different in general appearance from its Madagascar kindred, is an animal which may be almost counted upon as an exhibit. So too the slow loris (*Nycticelus tardigradus*) and the other loris of the East, *Loris gracilis*. The singular Malayan *Tarsius*, a small form with large ears, a frail body, and huge staring eyes, has never been acquired by the Society. It is eminently a desideratum.

The Slow Loris

This woolly-furred little lemur is for us the type of a sub-family of the lemurs which includes also the other loris of the East and the potto and the angwantibo of Africa. Like its allies, the slow loris is almost tailless, it has large, staring eyes, the index finger, "first" finger, as it is often called, is small—a stage on the way to its disappearance, which has occurred in the pottos. It is a small creature not much over a foot in length. Its home is in the East, to wit, Assam, Malaya, Siam to the Philippines in the extreme East. It is naturally arboreal, and, as its large and soft-looking eyes denote, nocturnal in habit. During the day it sleeps rolled into a ball, the head being bowed between the legs. In spite of the mildness of its eye, the little loris is not to be handled with impunity; its sharp teeth can leave a

mark. Coupled with this habit of biting is a partly carnivorous diet. The loris will eat almost anything in the way of vegetables, and it is also singularly adroit in catching birds. A mixed diet occurs, it will be observed, among groups of animals which have some claims to be considered archaic; thus, the venerable pig tribe is omnivorous. So too the Artoid carnivora, which are among the more ancient types of living bears, are mixed eaters. The slow loris has many vernacular names in the east; among them are "Bashful Cat," "Bashful Monkey," "Wind Monkey." These names have all a meaning; the first two, of course, are plainly to be referred to the slow and nocturnal habits of the little lemur. The last may be in allusion to its whistling note; but perhaps it has been given to it on account of the belief among the Chinese sailors that its voice presages wind. Much other superstition has gathered round this certainly rather weird-looking little Primate. Captain Flower has discovered that a general view is held in Siam that if a man commits a crime which he did not premeditate, some one has "unbeknownst" buried a piece of loris under his threshold. The amount of legend which envelops wild animals seems to be in some proportion to the singularity of their physiognomy. Thus, the singular Madagascar lemur, the Chiromys, with its eager eyes and long thin middle finger, is held to presage good fortune, if it brings a traveller in the forest a pillow and places it under his head. The story reminds one a little of the stone lion who wags its tail when it hears the clock strike twelve. The *Nycticebus tardigradus* carries its young one wrapped round its body like some other lemurs. It remains there, as do the young kangaroos in the pouch, until of large size. One wonders whether this habit may not be indeed a reminiscence of the earlier presence of a pouch in some ancient lemur.

HAPALEMUR GRISEUS

The Gentle Lemurs

English vernacular names are not as a rule particularly full of accurate meaning, for in many cases they are mere translations of a scientific name of Greek origin which may have a dim applicability in that tongue to some one, and that not always a striking, peculiarity of the animal so named, but which are apt to lose that faint significance when translated. The lemurs which form the subject of the present article are known to zoologists as *Hapalemur*, and there are two species, viz. *H. simus* and *H. griseus*, both of which are confined to Madagascar. This "simple lemur" is not, however, to be altogether trusted to keep up its alleged gentleness of disposition. It is furnished, as are other lemurs, with a row of closely set projecting serrated and sharp teeth in the front of the lower jaw, a marked lemurian characteristic, which could give a respectable nip to any one entrusting an enquiring forefinger to it. This little grey-coloured animal is nearly always represented at the Zoo ; at any rate, it is almost certain that the commoner species, *H. griseus*, will be found in one of the side cages of the monkey house. Not so frequently, however, the larger broad-nosed form. This, like other lemurs, has acquired its general name of lemur from its quiet and nocturnal, and, therefore, somewhat ghostly, habits. Not that it is altogether silent ; indeed, *H. simus* is said by Mr. Shaw to possess at least two modes of utterance which may correspond to diverse feelings. It may quack like a duck or scream. It is vegetarian and insectivorous, and a constant if not a greedy feeder. The lemurs in general form a race which has its present headquarters in Madagascar, though a few forms are found in Africa and even in the East. But in the past epochs of the world's history lemurs were European and American

also. They are a group which is somewhat intermediate between the more highly organized monkeys and the Insectivora (e.g. shrews, hedgehogs, etc.). With grasping hands and feet suitable for climbing and handling their food, is combined a crafty and long-snouted face, such as that of a fruit bat. The brain, that organ by which the higher Primates can be distinguished from the lower, is on a level with animals lying lower in the scale, and is not like that of monkeys. The Germans appropriately enough signalize this half-way character of the lemurs by terming them "half-affen"; and Dr. Forsyth Major has lately found the fossil remains of an animal which he thinks still more successfully bridges over the rather narrow gulf separating lemurs from monkeys. So much then for the relationships of our *Hapalemur* and of course other lemurs. Extreme agility is one of the most conspicuous qualifications of this lemur, and of those which are most nearly allied to it. Its energy of muscular movements contrasts greatly with that of the more torpid lemurs of West Africa, and of the eastern hemisphere. This can be readily witnessed in the cages at the Zoo. This rapidity of movement will render it a little difficult to inspect a curious peculiarity of *Hapalemur*, almost unique, so far as is known, in the lemur tribe. If the animal can be induced to lend itself to scientific observation, the visitor may note upon the wrist of the male a patch of black spiny structures, which are columnar and corn-like outgrowths of hardened skin. In the lady *Hapalemur griseus* these outgrowths are not present, but in the same place is a patch of black and naked skin. Precisely the same kind of structure is to be found on the foot, not on the hand, of an African lemur not very closely allied to this, and which is known as *Galago garnetti*. What the use of these roughened patches of skin may be is not known at present; obser-

vation will doubtless settle the point. It has been suggested that they are of the nature of "climbing irons," and aid the lemur in barking up a tree; but with an excellent and delicately fashioned hand such adjuncts appear to be unnecessary. Besides, why should the structure be different in the two sexes, if it be of this or an analogous direct use. More probably it is one of those mysterious marks of sex which often have no ascertained uses, such as the moustaches of the male man and the different colours of the plumage in many birds.

The Ungulata, or Hoofed Mammals

Horns and hoofs are the distinguishing feature of this large order of mammals; they are, furthermore, graminivorous, or, at least, vegetarian in habit, and, as a rule, walk upon the tips of the toes. But an inspection of the various Ungulates contained in the menagerie in London will show that some of these characters do not absolutely define every member of the order. The Hyrax, for example, walks firmly upon the sole of its foot, and has no horns. The elephant has no horns. These two animals are, in fact, representatives of Ungulates of a more primitive structure than the rest. The very earliest known members of the order, now extinct, had not acquired the more typical ungulate characteristics of their descendants of to-day. In many respects they showed symptoms of fading into other orders of mammals, particularly the Creodonta, the ancestors of the Carnivora of the present day. It remains, however, the fact that, though some Ungulates have not got horns, the existence of horns is absolutely confined to this order. In zoological classification even the veriest beginner soon learns that Nature draws no hard and fast lines, and that when an attempt to make

nice distinction is indulged in, that attempt is often contemptuously refuted by Nature. The most that can be done is to estimate all the characters that can be ascertained, and then a given animal can be referred to its place by a series of comparisons. For example, the little Kanchil, which we describe later, is an Ungulate, although it possesses no horns, and has strong canine teeth, which are often wanting in the group. We arrive at this conclusion by the consideration of the sum total of its anatomical structure.

We find, for example, that the feet are arranged on the plan of those of other horned and canine-toothless Artiodactyle Ungulates, while the stomach has nearly the complexity of that of those animals. The brain and other organs point in the same direction ; and so, in spite of lack of horns and strong development of canine teeth, we put the Kanchil near to the deer and their allies. This, however, is a simple instance which admits of no question. It is quite otherwise with the whales and dolphins ; no one has yet been able to put before the zoological world convincing arguments as to the place which the aquatic mammals occupy in the system. In no structural feature is there irrefragable evidence of the whale's place in Nature, though some would put them near the order which we are now considering.

Besides the possession of horns and hoofs and the usual disappearance or rudimentary condition of the canines, it will be noted that the Ungulata are practically entirely vegetable-feeding animals. It is true that in certain northern regions cattle are fed, when fodder is scarce, upon dried fish, and that there are a few other instances of the development of a carnivorous appetite in the group. But, on the whole, the Ungulata are a more purely vegetarian group than is any other of existing mammals. Related to this mode of feeding,

we find that the molar teeth, or cheek teeth, as they are sometimes termed, have flattened crowns suitable for triturating vegetable food; this contrasts with the sharp-pointed molars of many carnivora, which are equally fitted for rending flesh. These molars get during the life of their possessor much worn down, and thus present in course of time a flatter surface than those of carnivorous creatures, a character which the Ungulates share with the nearly equally graminivorous Rodentia.

A general glance at the various kinds of oxen, sheep, deer, antelopes and camels exhibited at the Zoo will impress, and rightly impress, upon the visitor two other features in which the Ungulates differ from other mammalian groups that inhabit the land. The first is size: Ungulates run large, while Carnivora, Rodents, Insectivores, Marsupials, and Edentates do not. There are small Ungulates, like the Kanchil, and some tiny antelopes not bigger than a small dog; but, on the whole, the group is one which contains large-sized creatures. Secondly, Ungulates are eminently creatures who use their legs as *supports* as well as for running purposes. When at rest a lion lies down; a horse lies down but seldom, and the statement is generally true of the whole series of Ungulates. Sheep and goats climb rocks, and there are one of two kinds of *Hyrax* (called on this very account *Dendrohyrax*) which live in trees; but, as a rule, Ungulates are plain living creatures of considerable swiftness. On the whole, there is in this group of mammals a tendency to a reduction or even a practical loss of the hair and fur. Animals belonging to such diverse groups of Ungulates as the rhinoceros, the elephant, the hippopotamus and the babyrussa, have but a scanty growth of hair; and even in the deer and antelopes the hairy covering is by no means so dense as is the fur of a cat or a rabbit. The

thick skin of many of them led to the old name of Pachydermata for this group, which, however, then embraced some other forms. In short, if an animal is large, if its hair be coarse and not dense, if it walk upon its toes and not on the flat of the foot, if its grinding teeth be flattened on the grinding surface, if its canines are absent or insignificant, and if it possess horns, it is certain to be an Ungulate. The Ungulates are a large group, large in numbers, that is to say, as well as in size of individuals. They are found all over the world, with only the exceptions of Australia and some of the adjacent islands, and New Zealand. Tropical Africa may perhaps be regarded as their headquarters, for here abound antelopes of many species (but not a single deer), oxen, rhinoceros, elephant, hippopotamus, many pigs, and the hyraxes. Zebras are found here, and here only, and the hippopotamus is nowadays restricted to that continent. Next in variety of kinds come certain parts of Asia, where tapirs, elephants, rhinoceroses, deer, oxen, and antelopes are met with.

The several names used imply a possibility of a subdivision of the Ungulata into smaller groups ; and this can be done by easily recognizable, and even quite external, characters. To these external characters correspond certain marked differences in the structure of the bones, of the muscles, and of the various organs of the body, particularly the brain, stomach, and some other parts of the alimentary tract. We may in the first place cut off from the main Ungulate body the hyrax and the elephant, each of which types forms a very distinct group of its own. The hyrax contrasts with all other existing Ungulates by the following assemblage of characters. It is of small size, with a short tail and rather dense fur. It is plantigrade, i.e. it walks upon the soles of the feet ; the hoofs are not so markedly hoofs as in the horses and oxen, etc., but more

like flattened nails. It can climb both rocks and trees (that is, various species can), and lives in burrows, which Ungulates generally do not. It has very strong and chisel-like incisor teeth in the front of each jaw, which are by no means unlike those so characteristic of rodents. The molar teeth, however, are more like those of the rhinoceros. The elephants form another and an equally distinct group. Their characters can be readily verified with a little trouble. The massive form and straight limbs, not bent at the knee or elsewhere, and the scanty hair distinguish them from others; but it must be borne in mind that the extinct mammoth was copiously clad with hair, and so may have been other extinct forms, with whose bones and teeth we are alone acquainted. The trunk is a third feature, of which, however, there are the beginnings in the tapir. The gait is partly plantigrade, and the bones show that the fingers and toes are the unreduced number of five to each limb. The enormous tusks, which are in reality an exaggeration of the large rodent incisors, mark out the elephants, and the fact that only one or two of the particularly large molar teeth come into use at one time in each jaw is another feature of the living but not of all the extinct elephants.

The remaining Ungulates fall readily into two groups, the Artiodactyles and the Perissodactyles, names which we owe to the late Sir Richard Owen, which may be fairly grouped together in contrast to either and to both of the two groups which we have already characterized. In these *Ungulata vera*, as they have been termed, we have the furthest development of Ungulate characters. The gait is purely digitigrade, and in connexion with this is a lengthening of some of the bones of the feet and hands. It is in this section only that horns are developed, while the hoofs are more perfect *as* hoofs. The fingers and toes are always reduced from the

original five, and only one is left in the horse and its allies, and two in the oxen and deer—that is, in each case one or two perfect toes; for there are vestiges of two others in each case, with certain exceptions, where "*perierunt etiam ruinæ*, the very rudiments are tiny."

The Perissodactyles embrace the horses, rhinoceroses, and tapirs, which are sufficiently dealt with in the pages which follow. The Artiodactyles are first of all divisible into two main groups, the Bunodontia and the Selenodontia. These names are derived from the characters of the molar teeth, which are tubercular in the one upon their grinding surfaces, and with a half-moon-like pattern in the other. The Bunodonts are the pigs and the hippopotamus; the Selenodontia are again divisible into four groups, viz. Tragulidæ (see kanchil), Giraffidæ (see giraffe), Camelidæ (see lama), and the Pecora. The Pecora itself consists of the hollow-horned ruminants (see urus) and the solid-horned ruminants (see elk). The former embraces the antelopes, goats, sheep, and oxen, the latter the deer. The further characteristics of these various types is given under the description of those selected for comment.

The Tapir

This swarthy beast has undoubtedly a pig-like aspect. This is induced by its rotund form, its short legs with their three or four toes, the curtailment of the tail, and perhaps the rather small eyes. These appearances, however, are quite deceptive; the nearest living allies of the tapir are the horse and the rhinoceros. With these the tapir forms a subdivision of the Ungulate animals known as the Perissodactyla, characterized, as far as external characters go, mainly by the fact that among the fingers and toes one median finger or toe is predominant and occupies the median axis of the limb,

the others being subsidiary and arranged on either side of it. On the other hand, in the cow tribe, or Artiodactyle, there are two fingers or toes symmetrical with regard to each other, and lying on either side of the median axis, which passes between them. Different though the outward form of the tapir is to both its living relations, a survey of extinct types of all kinds shows a group or groups in the past with nebulous outlines fading away at the edges into both horse-like creature and unmistakable tapirs. The mountain cow, as this animal by another misnomer is sometimes termed, is called, after Linnæus, *Tapirus terrestris*. The specific name terrestris had, but has not, a point. Linnæus placed the tapir with the hippopotamus, and distinguished one as "amphibius" from the other as "terrestris," names signifying their varied modes of life. As a matter of fact, the tapir is quite at home in the water, and prefers marshy surroundings. De Buffon terms him with some reason "a dull and gloomy animal who never stirs out but in the night." The French naturalist also comments, *apropos* of the tapir, upon the poverty-stricken appearance of the fauna of South America, as compared with Asia and Africa. It is true now as it was when Buffon wrote, that no very large beasts haunt the forests or plains of the South American continent, but we no longer believe that this is due to "something in the air." At the Zoo the tapir is a constant resident. Its mobile and even flexible proboscis cannot really be compared with that of the elephant, to which it apparently bears an exact resemblance, differentiated only by its smaller size. But the Roman-nosed "Shire" horse has a trace of a similar proboscis in its fleshy and arched nose, which overhangs more than in the Arab race. The proboscis, in fact, is not a mark of likeness to the elephant, between which and the tapir there is no relationship other than

MALAYAN TAPIR

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that implied by the fact that both belong to the great order of Ungulata. The tapir's "lights," in fact, tell the same story as its bones. There is no ruminating stomach, as in the Artiodactyle type, but instead a huge cæcum like that of the horse and rhinoceros.

The dark hues of the American tapirs (there are about four to five known species in Central and South America) suit the dim forests in which they move. And accordingly, one might think that the Old World tapir, with its belly-band of white, would be on that very account a conspicuous creature to marauding tigers. This is, according to Mr. H. N. Ridley, not at all the case. The innocuous tapir, with no means of defence save its heels, and they for flight, trusts to its likeness to grey and scattered boulders, frequent along the streams of the Malay peninsula, which it haunts. "When lying down in the day," observes Mr. Ridley, "it exactly resembles a grey boulder." The blackness of the tapir is a sign of maturity. The young animal, as is so often the case among mammals (e.g. the deer, the young of the puma, etc.) are flecked and striped with white. Those who have observed young tapirs wild, say that this spotting is an excellent preventative of slaughter by carnivorous beasts. When quietly lying down, the spots and stripes harmonize with patches and dots of sunlight piercing the trees and bushes of the forest lands which they prefer, and readily deceive even the trained eye of the naturalist or hunter. But of all such cases of supposed protection by likeness to environment, one is compelled to suggest that they depend for their probability, not only upon the eye of man, who is at most only a recent foe of the animal world, but of other creatures who have hunted tapirs long before man was born into the world. In this case, how is it that the sense of smell, which is admittedly much keener among the majority of both

hunted and hunting beasts, is negatived by the sense of sight ?

The Rhinoceros

This great Ungulate shows all the typical characteristics of the Perissodactyla which have been already and will be referred to. For some reason or other—probably blackness and large size—it is confounded in the popular mind with its very distant relative, the hippopotamus. It certainly occurs in Africa ; but is purely terrestrial, or, at most, marsh-frequenting. The rhinoceros is the only living Perissodactyle Ungulate which has horns on the forehead or anywhere. These horns, however, are not strictly comparable to those of goats and sheep, of deer and antelopes. They are to be looked upon as simply masses of agglutinated hairs which are borne upon a roughened, at most slightly raised, area of bone. The African rhinos have two of the horns ; some of the Asiatic forms have also two, the others have but one. Next to the presence of horns, the most salient characters of all rhinoceroses is their thick and often folded skin, covered as a rule with but scanty hair. It is truly a " Pachyderm," and one does not wonder that Albert Dürer, in his celebrated drawing of the Indian form (*Rh. indicus*) represented it as armour-plated with indriven bolts. The strength of the rhinoceros is attested by the thick bars which hedge it in its cage at the Zoo, and its danger to human beings by the iron " refuges " for the keepers to escape into if hard pressed. But it seems doubtful whether the rhinoceros is so fierce as it has been asserted to be. It is true that the poet, ingeniously rhyming, has said—

If ever you meet a rhinoceros
Do not linger but flee
Up the very next tree :
He's a match for the gods ; he can toss Eros.

AFRICAN RHINOCEROS

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But, on the other, a naturalist in Africa related that a toy terrier put a rhinoceros to ignominious flight by its barks. The probable explanation is that the rhinoceros, when once set going, continues on in the same straight line, in obedience to the Newtonian law; under these circumstances, as with Stephenson's locomotive and the hypothetical cow, it is so much the worse for anybody who happens to come in its way. It is no more ferocious, in fact, than a cataract or an express train. It is true that "Theodore," an African rhinoceros lately on view at the Zoo, but now no more, was irritable. But we cannot argue from a captive to a freely roaming beast. Legend has encrusted the rhinoceros as thickly as Nature has. Its horns make beautiful translucent drinking vessels, which so lately as the year 1762 were reputed as test of poison. "When wine is poured therein," wrote Dr. Brookes in that year, "it will rise, ferment, and seem to boil; but when mixed with poison it cleaves in two, which experiment has been seen by thousands of people." Our second best diarist, John Evelyn, saw during his travels in Italy a fountain which was kept sweet and free from poison by a rhinoceros horn. It is held, too, that the branch cast into the waters of Marah was a horn brought with him by Moses from Egypt. As for unicorn legends, they are manifold. But it always seems to us that the rhinoceros was not the prototype of the "lufar unicorne." That fabulous beast, as every one knows, is compounded, at least in heraldry, of the body of a horse well maned and of the horn of a narwhal. To get that out of a ponderous rhinoceros is difficult even for the imaginative natural history of the ancients. No rhinoceros could slumber upon a maiden's breast, unless indeed the maiden were of the Barnum and Bailey kind. Much more likely is it that the unicorn is a small and graceful gazelle with, as rarely but occasionally happens as a

freak, but one straight horn. The rhinoceros has been seen in Europe and even in England long before the opening of the Zoological Society's gardens. The animal which was sketched by Albert Dürer was sent over in the year 1313 to the King of Portugal. It proved so intractable, or the Portuguese king appreciated it so little, that he sent it as a present to the Pope! The head of the Church, however, was relieved from the anxiety attendant on the housing of so "fearful a wildfowl" by the actions of the rhinoceros itself, who, "in an access of fury sunk the vessel on its passage." In the year 1684 old John Evelyn "went with Sir William Godolphin to see the rhinoceros or unicorn, being the first, I suppose, that was ever brought to England. She belonged to some East India merchants, and was sold (as I remember) for above £2,000." The price of rhinoceroses did not diminish very greatly after the expiration of a century and a half. For the first specimen acquired by the Zoological Society, in 1834, cost no less than £1,050. Still later, in 1875, even more was given for a rhinoceros. The original specimen of a reputed new species, not now allowed as a species, viz., *Rh. lasiotis*, cost no less than £1,250. This animal from Assam was sent for specially, and only died the other day. Its remains repose in the Natural History Museum. The Gardens are never without more than one rhinoceros nowadays. A large Indian rhinoceros (*Rh. indicus*) was once the object of an interesting experiment in medicine. It appeared to suffer from simply a stomach-ache. The late Mr. Bartlett, daringly experimentalizing, offered it eighty drops of croton oil on a bun. The beast swallowed the dose, enough to kill ever so many men, and—recovered.

HAIRY-EARED RHINOCEROS

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QUEEN VICTORIA'S GIFTS

Grevy's *Zebra*

This splendid zebra, the very culmination of zebras, is one of the most striking exhibits in the Regent's Park. It is, too, one of the chief novelties which recent events have enabled the society to add to their menagerie. So lately as 1899 the first two examples were procured through her late Majesty Queen Victoria, who received them as a gift from the Emperor Menelik of Abyssinia. With her customary liberality, the Queen placed these horses in the Zoological Gardens for exhibition to the public. The zebra had, however, been known to us before that date. In 1882 the first specimen now in Europe was sent by the same Emperor to M. Grévy, late President of the French Republic, and the beast was described as new to science by the late Alphonse Milne-Edwards. It seems, however, that the fellow explorer with Speke, Colonel Grant, had seen and preserved an example of the same zebra so long ago as 1860 ; but he only described it later, in fact not until 1883. So much for the history of this the king of zebras. *Equus grevyi* can be readily distinguished from the other zebras, all of which, as every one knows, are purely African in their range, by a number of salient characters. It is a larger beast, and especially has a large head and ears, the latter being particularly hairy. The black and white bands are very definitely black and white as the variety of Burchell's zebra known as *Equus Chapmanni*. In other zebras there is a tendency to dulness in the black, which occasionally is even brown. The closeness of the stripes and their arrangement may be seen to differ from the mountain zebra, which perhaps comes nearest in striping. But this can be seen in a shorter time than it will take to write a description. It is probable, in fact, that Grevy's zebra is much more distinct from all other zebras, including the quagga,

than any of these latter are from each other. The Somali name of this zebra is Fer'o. Captain Swayne found them in that part of Africa in droves of six. He further observed that the young animals were beset with a closer coat of hairs than their parents, and that the black of their skins was dingy and brownish. Like all zebras—and this is the greatest source of annoyance to the sportsman, for the animals will mob you and thus warn off other game—they are curious and inquisitive, even impertinent in their attentions. They bray " like an Abyssinian mule," but they are not to be despised from a gastronomic point of view. This latter character did not impress Colonel Grant so favourably, for he found in their flesh a very horsey taste.

The Wild Ass

Of wild asses there are certainly two species, if not more. In Asia we have the onager, and in Africa the parent of our donkey, the Nubian ass, *Equus asinus*, or, apparently better, *E. africanus*. In the Asiatic ass there is merely a long dorsal stripe running down the length of the back; in the African ass, besides this stripe, a cross bar on the shoulders—in legend, the marks of the Saviour. These two forms, which are really quite distinct from each other in correspondence to the continents which they people, are subdivisible into other races which may or may not have the value and rank of " species." In Asia we have first of all the hemippe (*E. hemippus*) of Syria, and the thick-coated kiang (*E. hemionus*) of Thibet, furred to stand the wintry climate of its mountainous home. In Africa Somaliland nourishes an ass known as the *Equus somalicus*, with stripes upon the legs, but no stripe upon the shoulder on each side. We have, in fact, in the zebras and donkeys a series of stages between plain

GREVY'S ZEBRA

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coloration and elaborate striping. The quagga, with its striped foreparts and plain hindparts, is a kind of terrestrial mermaid compounded of the forequarters of

ASIATIC WILD ASS.

a Burchell's zebra, with the hindquarters of a plain donkey. It is intermediate between the two races, and the danger of lingering at a halfway house is evidenced

by the fact that it is now, and has been since at latest the year 1878, extinct. Before considering the onager, it will be useful to enquire how far asses are to be distinguished from horses. To differentiate the domestic horse from its brother in harness is easy for the most un-zoological of observers. But Prjewalski's wild "horse," and the Celtic pony, land us in difficulties. The wild horse has a donkey's tail for part of the year and the typical horse's tail haired up to the root for the rest of the season. The Celtic pony has the single pair of "chestnuts," only those of the fore limbs, which otherwise distinguish horses from asses; for in the domestic horse and in Prjewalski's there are also chestnuts on the hind limbs. Furthermore, we cannot regard striping as an exclusive possession of the donkey tribe, for traces of cross bars appear again and again in the most flagrantly domestic of horses, especially after crossing has had its influence. The onager is very generally, if not absolutely invariably, to be viewed at the Zoo, and a handsome beast it is. It is no use, as a rule, to satisfy oneself concerning the appearance of some rare beast by the observation of stuffed specimens only. A stuffed animal is, especially was in past days, apt to be as like its living descendants as the self-made man is to the Apollo of Belvidere or to the Faun of Praxiteles.

Its hues are of the desert, and it shares them with the jerboa and the lion. It may be observed incidentally that popular notions of a desert, derived in all probability from illustrated Bibles, of the kind that come out in sixpenny parts, would define it as a tract of particularly yellow sand with an oasis in the foreground and a clump of Arabs in the middle distance. Deserts are not all of this plan of coloration. Mr. Scott Elliot has figured an African "desert" which presents the appearance of a charming English woodland scene, not remark-

able for sand and Arabs in the offing. In Central Asia, however, the desert is generally of the more popular character, and here it is that onagers frequent the stony ground and offer sport to the horseman. This sport is carried on, among other places, in the very appropriately named " Runn of Cutch," and it is said that the wild ass is not so fleet as legend would have it. In twenty-five miles the wild ass can be run down by an expert rider. It is not of much use economically when it is run down. This wild ass and its very near relative, the kiang, suffer from the same curiosity that marks the zebra. The fondness of the costermonger's donkey for thistles and its resolute voice need not move us to vulgar mirth ; we may, in fact, be as sentimental over the facts as Sterne. The two characters indicate in a most interesting way the past history of the domestic ass. Thistles are of the kind of plants which stony localities produce, arid and thick skinned, to preserve what little moisture is necessary to their existence. That the donkey prefers them now is surely a sign of former life in stony places. So, too, its dislike of water, and its habit of rolling in the dust. The voice is held to be a danger signal to its fellows. It always reminds us of the final notes in the roar of that animal whose skin the donkey once wore.

The Wart Hog

To represent the pig tribe we shall select this animal, which is entirely African in habitat, and is to be divided into two distinct species of which the technical names are *Phacechoerus aethiopicus* and *P. africanus* (formerly known as *P. Aeliani*). The wart hog is with some justice described as a " superlatively ugly " animal. Its peculiarities of visage, to use a milder term, are mainly due to various excrescences upon the face, almost if not quite of the nature of horns. A pair of these in front of

and below the eyes are especially large; and their situation recalls the fable wherein Momus is made to criticize the bull made by Zeus on the grounds that the horns should have been placed below the eye so that it could see where to strike. The wart hog can, or, at least, could; for it uses its long and upcurved tusks for aggressive purposes. These tusks, like those of others of the pig tribe, notably the babyroussa, are perhaps to be looked upon as being originally of a pathological nature. Being found useful they were retained by Nature. Though the wart hog has these weapons ready to hand, it is not of particularly fierce nature; and those at the Zoo have as a rule been placid and quite porcine creatures with a fondness for being scratched with the end of a walking stick. In Africa they go in herds to some extent, and live in the deserted burrows and mounds made by the aard vark or *Orycteropus*. It is related that when leaving these burrows they turn a kind of somersault at the front door which is apt to be damaging to a bystander who is too close. It does not appear whether the wart hog evicts the peaceful *Orycteropus*, or is only an inhabiter of deserted houses. Like other pigs, the wart hog has, it can readily be observed, four toes on each of its fore legs, of which the larger two are in the middle and the smaller outside and not reaching the ground. Take away the outer, and nearly functionless, toes and the state of affairs characteristic of the deer, oxen and antelopes is arrived at. In fact the pigs are an ancient race, and this is one of the anatomical facts which shows it. On the fore limbs are wart-like structures caused by the habit of the animal of kneeling. It has been lately shown that these warts are not altogether produced during the lifetime of their possessor, in response to frequent kneeling, like the horny hand of the blacksmith; but the young, before they have

WART HOG

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had time to develop them properly, show unmistakable traces of them. Now it cannot be doubted that we have to do here with a clear case of the inheritance of acquired characters.

In South-East Africa the lengthy name of the wart hog is nothing less than Indhlovudawani. After this one may well reply to the general query of "What's in a name?" with the answer, "A good deal." Though vernacular names of beasts should be really vernacular and not pseudo-vernacular, like "the rude dog" for *Canis rudis*, there is a limit, and we propose to stick to wart hog in these pages. Representatives of the wart hogs have been exhibited in the Gardens fairly continuously since the year 1850 when the first example was received. Aelian's wart hog was apparently first shown in 1861, when a specimen was deposited by her late Majesty, which had been given to her by that rather celebrated potentate the King of Ashantee. It appears that the wart hog is not bad eating. The late Dr. Crisp dissected one that had died suddenly at the Zoo, and cut off a chop for private consumption. It is not surprising to hear that he "was werry much like pig." The doctor furthermore made the excellent suggestion on the strength of this banquet that a cross between the wart hog and the domestic pig might result in superior bacon, for the ribs of the *Phacochoerus* are especially thickly covered with meat. This and the other kinds of pigs possessed by the Zoological Society are housed in adjacent enclosures, so that their but slightly divergent characteristics can be readily compared by the visitor. The fat and depressed body of this pig contrasts with the leanish compressed body of the wild boar, the ancestor it is presumed of the bacon-producing porker.

THE VOICE OF THE HIPPOPOTAMUS

Hippopotamus

Behemoth of the Book of Job is not, as most persons believe, the African hippopotamus in spite of the fact that the artist poet Blake so drew it. A recent author (the Rev. M. G. Watkins) has pointed out that Behemoth is clearly the same word as Mammoth, inasmuch as in the Arabic language "b" and "m" are interchangeable. Furthermore in the Book of Job "Behemoth" is said to "move his tail like a cedar," "he eateth grass as an ox," "he lieth in the covert of the reed and fens" and lastly, "he drinketh up a river." Now all these phrases of description plainly point to an elephant rather than to an hippopotamus, especially the last, which might at first sight refer to the river horse. For the copious draughts of an elephant are familiar to those who know the beast, while the aquatic hippopotamus is not actually seen to drink at all. Having settled what the hippopotamus is *not*, let us inquire what it *is*. Linnæus, as we have already mentioned in dealing with the tapir, confused it with that animal, which which it has only the remotest relationship. The hippopotamus, in fact, belongs to the Artiodactyle section of the Ungulates, and is near to the pigs. The dwarf hippopotamus of Liberia even approaches in its habits to the pig tribe; for it eschews the river and wanders about through the bush. The term river pig would thus be much more suitable than river horse, the name which is given to it both in English and Greek. Its voice has, it is true, been compared to the "neigh" of a horse; it appears to us much more like a gruff version of the sound made by the horse's poor relative. But this sound is only repeated once, a deep base "Hee-haw." The outward aspect of this huge "Pachyderm" is familiar even to those who have never seen the beast alive. The main points to

HIPPOPOTAMUS

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be noticed about it, and which fix its place in the zoological system, are these. It is a great thick-skinned beast with but few hairs; thickness of skin and fewness of hairs are characters which are often found among the Ungulata, witness the elephant and the rhinoceros. On its bulky head the eyes, ears and nostrils are situate rather towards the top and at the same level more or less; this is an advantage to the animal when floating in the water; for it can breathe, hear and smell with the least possible exposure of body. There are four toes on each hand and foot, a point of likeness to its nearest allies the pig tribe. Its teeth are enormous and make good ivory. It has, moreover, a very good set of them, front teeth as well as back. The more typical Artiodactyles, the Ruminantia (e.g. deer, oxen, antelopes), have entirely lost their upper incisors, and mostly their canines. To reconcile the dangerous-looking teeth with a vegetarian existence requires faith in the observing powers of those who have studied the hippopotamus in a wild state; but this faith may be safely reposed. The hippopotamus produces at times, especially after just leaving the water, a remarkable secretion from the skin of a carmine character, which bears at least a superficial resemblance to the equally carmine secretion of the red kangaroo (*Macropus rufus*). This fluid contains granules of the carmine-coloured pigment; and it was first studied upon the original specimen of hippopotamus acquired by the Zoological Society in 1849. Its use remains a mystery; but it is believed to have suggested to the Egyptian priests their deception of the "bloody sweat." In the early natural history of the hippopotamus fact is mingled largely with fiction; indeed, it might be more accurate to say that fiction is lightly salted with fact. Even Buffon allows that in what Aristotle said of the hippopotamus there were more errors than facts.

Pliny naturally copied his master, and added to his errors. According to Buffon the first good account of the hippopotamus was given by one Frederico Zerenghi, who wrote in the year 1603. It must be admitted that in that account there is much that is both new and true. He observed the four toes, the enclosure of the teeth in the mouth when closed, the correct size, and noted that then, as now, whips are made of the thick skin, sjamboks in fact. But in repeating the assertions of others Zerenghi goes astray; for he quotes legend to the effect that the animal feeds upon fish, crocodiles, and dead human bodies. He himself, however, noted that rice and grain were consumed by the animal, but was misled by the great fangs into placing credence upon its flesh-eating propensities. There is no doubt that though the hippopotamus does eat vegetable matters its teeth are used as offensive weapons. Mr. Consul Petherick, who brought over a specimen for the Zoological Society in 1860, related how a hippopotamus "suddenly raising half its great carcass with an agility hardly to be expected out of the water, close under the bows, carried off my unfortunate cook from the gunwale on which he was sitting, one bite of the animal's powerful jaws sufficing to sever his body in two at the waist." Other travellers have told similar stories. The hippopotamus, being an aquatic creature, naturally can dive with ease and stay under water for some time. There has been some exaggeration as to its capacities in this respect. Sir Samuel Baker limits its endurance to ten minutes; but Mr. A. D. Bartlett, the late Superintendent of the Zoological Gardens, found that a new born hippopotamus remained at the bottom of its tank for no less a period than fifteen minutes, whence it was fished up in a perfectly lively condition. The hippopotamus will occasionally put out to sea, and the fact that it will

do so is of interest in this matter. Remains of hippopotami have been found in Madagascar, which is known to have been for æons separated from the African continent ; they must have originally got to that island by a marine route failing a land bridge, which latter of course accounts for their remains in Europe, Asia, and in the valley of the Thames. The same explanation may account for a recent and most exciting " find " in the island of Cyprus. Plenteous bones of a hippopotamus have been unearthed in that island, which clearly belonged to quite a small animal, not larger than an average sized pig. It is striking as a fact of comparison that Malta harboured in days gone by an equally tiny elephant. Thus a minute environment appears to produce in some cases a small frame in its inhabitants. There was great excitement at the Zoological Society on December 11, 1850, when a letter was read to the meeting announcing the sending of the first live hippopotamus to the Gardens. It was presented by H.H. Abbas Pasha, who detached a guard of honour to bring the young beast into Cairo. It was there liberally treated with thirty quarts of milk daily. Since that year the Society has never been without hippopotami. It is a testimony to the care bestowed upon wild animals at the Zoo, in the past as well as in the present, that the hippopotamus has bred so often at the Gardens. On no less than three occasions have young been born, one young male in 1871 and two females in 1872. Since then the animal has been reared in other Zoological gardens, for example at Amsterdam.

CHAPTER IV

The Deerlet

A FIRST glance at the little creature known as the Chevrotain or "deerlet" (*Tragulus meminna*) would not establish a definite idea in the mind as to its exact position in the animal kingdom. It is not unsuggestive of one of the long legged rodents, such as the agouti; it has also a slight hint of a marsupial about it. The hornless head seems to forbid its association with the group to which its feet evidently and certainly ally it. The fact of the matter is that the hesitation caused by the undeerlike aspect of *Tragulus* is perfectly reasonable, inasmuch as the creature is not definitely a deer though nearer to those animals than to any other group. It will be observed that the feet are four-toed, though the two middle toes have the preponderance and are symmetrical in themselves as are those of the deer. The toes, indeed, are perfect pig's trotters. We understand by a pig a beast of obese not to say ponderous build; while the slenderness and agility of a deer is proverbial. In the person of *Tragulus* we have a mingling of the two groups, and there is little doubt that in this mammal we have an archaic form of ruminant preserved for us. Its stomach is simpler than that of a true ruminant, and it is clear that this animal exactly fills up the position to be occupied by an animal which divides the hoof and does not chew the cud. Its small size is in accord with such a placing at the base of the Artio-

dactyle series, for we know from much evidence that when a group appears it comes into existence in a modest and shrinking way, to wax fat later in its history. Smallness of size is a great advantage in the battle of life, especially when there is not much in the way of defence. This animal being hornless must trust to size and swiftness for escape. It is said, however, to add to these two qualities a third, that of cunning. These little deer behave in the face of danger like a good many animals belonging to quite different groups of the animal world. Beetles, opossums and raccoons, when hard pressed, and when avenues of escape seem to be cut off, feign death, and then, when the danger has passed by, get up and run away. It is, however, a question whether this shamming is really a trick, or whether it is a genuine faint or cataleptic trance produced by the near proximity of the terrible. The mind of the beetle would seem to be too embryonic to have contracted an advantageous trick with a beneficial result. But on the other hand it might be urged that the nerves of the beetle were of iron from their very imperfection, so that a possible explanation is hemmed round on all sides with difficulty.

A careful inspection of the cunning " Kanchil," as the Malays call the animal, will show that it has what few ruminants have, quite formidable tusks in the upper jaw. These tusks have led to the quite erroneous confusion of *Tragulus* with *Moschus*, the musk deer, a totally different animal, a definite deer belonging to the family Cervidæ, though usually dignified with a sub-family to itself. In the Kanchil or Meminna, to use two of its native names, these tusks play, it is asserted, a somewhat novel part for tusks to play. These teeth, which correspond of course to the tearing canines of the Carnivora, are alleged, with what truth we cannot say, to allow the kanchil to suspend itself from the branch of

a tree when hotly pursued by an enemy. The actual founder of the Zoological Society, whose bust adorns the Lion house, was told, and has told us, that a kanchil will neatly leap into a tree when fugitive and remain there in a state of suspense by its long canines. All we can say is, there are the teeth and here is the story. The tusks, it should be added, are an attribute of the male. The only living ally of the *Tragulus* is the African *Hyomoschus*, a shorter limbed but small deerlet, which is also of a brown colour with spots and stripes. One species of kanchil, *Tragulus stanleyanus*, recalls the memory of one of the early Presidents of the Zoological Society, the Earl of Derby, whose menagerie at Knowsley was sold in the early fifties, and the inhabitants largely drafted off to our Zoo.

The Reindeer

The reindeer, *Rangifer tarandus*, is unique among the deer tribe by reason of the fact that both sexes bear horns. In other deer, as is well known, the stags alone are horned, the does being hornless. The reindeer, like the elk or moose, is circumpolar; and also like that animal, the American have been distinguished from the Northern European and Asiatic forms. More than this indeed; according to the most recent estimate of likenesses and unlikenesses nine distinct species of reindeer are allowed to the American continent and adjacent regions including Greenland. With the splitting of species we have nothing to do here save recording that it is mainly American in its inception, but has been eagerly followed in this country by some whose knowledge of animal life is limited to an acquaintance with the dead skin and the dried skull. In Europe the reindeer is not merely "game"; it is used by the inhabitants of Scandinavia, and has been from times of antiquity, as a beast of

REINDEER

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draught, and as a milk and flesh producer. Indeed of the Laplanders and some of the reindeer keepers of the North, Cæsar's famous remark of another race might be repeated: "Cibus eorum lacte caseo carne constat." Its outward appearance is not on the whole unsuggestive of its near neighbour geographically speaking, the moose. It has an approach to the long and thick upper lip of the latter, while the somewhat clumsy feet and legs, and the often palmated horns, add to the resemblance. Its feet are planted firmly upon the ground, firmly even to splayness; and this is in relation to an easy transit over yielding snow and marshy land. It is exactly paralleled in the divaricated hoofs of Speke's antelope, which also inhabits swampy, and therefore treacherous, ground, but in Africa. Its young are not spotted as are those of most deer. Its pelage alters in colour from summer to winter as it also does in many other deer. As for other points in its structure, the reindeer is quite obviously a deer. Reindeer the vernacular, and Rangifer the Latin, name of this animal appear to be mainly derived from the same word; at least it is certain that the termination "fer" does not mean here as that termination in Latin generally does mean, a carrier or bearer. It is simply the Latin *ferum* a beast, which of course is the same as deer in English (= Thier in German). As for "rein" it would seem to be Laplandish. The European and Siberian reindeer had in past days a wider range than now. In prehistoric times it of course wandered south through Britain and France; and its effigies scrawled upon tusks by primæval man are well known to everyone. But further than this the reindeer seems to have inhabited the extreme north of Scotland as late as the twelfth century, when in Caithness it was hunted for sport. The American reindeer are called by the American zoologists Caribou; this is not an Indian

name, as might be surmised from its sound and spelling, but a corruption of the two French words, "carre bœuf" or square ox. So Mr. Maddison Grant, the secretary of the New York Zoological Society, and one of the latest authorities upon the reindeer tells us. It is impossible to say much about deer without dwelling long upon the antlers. "Ex cornubus cervum" might almost, but not quite, nowadays be said. The horns of the reindeer-caribou are noticeable for the extreme development of the brow tine, which projects forward over the face, and is often divided into many "points." It has been asserted that this part of its armature is meant for the peaceful purpose of shovelling away the snow which covers its lichen foods. But more likely seems the view that it is a defence against blinding in the combats of the males in the breeding season. Naturally the horns of the males being used for these aggressive purposes are larger than those of the females; and indeed in the latter sex the horns are said to be completely wanting in one race or at least in some individuals. Besides the large brow tines and the frequent palmation of the horns, the reindeer horns are remarkable for the fact that there is generally a large region without any branches whatsoever except a small tine. This great expanse of unbranched horn is eminently characteristic of the deer. As to "points," i.e. the branches of the horns, forty appears to be the outside number nowadays, though fifty are not quite to be regarded as imaginary. The definition of a point, according to Mr. Grant, "is a knob upon which a watch can be hung."

The Moose or Elk

As another example of the deer tribe we may take this the most striking member of that group. It is a beast of noble appearance though somewhat leggy, and

it is quite the largest existing deer. The bull alone has horns, as is the case with most deer, the reindeer, a near neighbour of the elk, being the most salient exception. It is usual to term the American elk the "moose," and to reserve the name "elk" for the European beast. But in truth the elk is, like so many northern animals, e.g. the brown bear, circumpolar in range. Like many creatures now limited to the north, the elk had in past times a wider range, and remains of it have been found even in the prolific gravels of the Thames valley. But the elk was never historically an inhabitant of these islands; and it must of course not be confounded with the "Irish elk," which is a more typical deer in its characters. The elk has particularly large horns which are "palmated" as the expression goes; that is to say, each horn swells out soon after its origin from the head into a flat expansion, from which arise the comparatively small tines. Of these tines there may be as many as sixteen, but as a rule there are fewer. The fact that these horns are at times non-palmated, like those of the red deer, for example, has led to the creation of various species for those individuals; but it seems probable that the deficient growth of the horn is rather a matter of nutrition than of species distinction. The Canadian moose has an ingenious method of protecting itself against wolves in the winter. It tramples down a definite area, which is known as a "moose yard," and securely entrenched in this it is able to defy its foes by bringing into play its heavy and sharp pointed horns. It is plain that a moose travelling through a dense thicket would be incommoded like the stag in the fable, and unable to deal efficiently with carnivorous foes. The European and Siberian elk may have less difficulties, and after all it seems to live much more in the open. The most un-deerlike point about the elk is its projecting and fleshy nose,

in the possession of which it suggests the antelope known as the Saiga.

The American moose is a larger animal than its European relative, and it is mainly on this account that it has been proposed to separate the two specifically. In this case the name elk is to be reserved for the Norway beast, and moose for the Canadian variety. The word moose is a native name and therefore an excellent vernacular word to use. It is of the Algonquin language and seems to signify "wood eater."

There are frequently examples to be seen at the Zoo.

The Urus

For a good many years past the Zoological Society have been in possession of examples of the British wild bull: and so satisfactory are the conditions obtaining in the cattle sheds at the Zoo, that these animals have regularly bred, and the calves reared to maturity. The ox is white and should have red ears and a black muzzle. Black ears occur; and it is thought that white is not the primitive character. Indeed white is not as a rule a colour found in Nature though many examples can be at once quoted of its occurrence, such as the pelican, the bell bird, etc., etc. These animals, semi-domestic in the parks of Chillingham, Cadzow, and elsewhere, are in all probability the real and comparatively unaltered descendants of the primitive wild ox of Great Britain and the continent of Europe. They appear, however, to be smaller than the original and wild *Bos primigenius*. We know the latter of course by its subfossil remains in fens and peat-bogs. It seems that in very early times, at any rate in those which we call "Neolithic," the urus was tamed by man and kept for the sake of its milk and beef. Cæsar's description of the Gauls would seem to apply to Neolithic man in this country; he no doubt was of those

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whose food consisted of milk, cheese and flesh. This inference is drawn from the curious fact that the remains of calves are particularly abundant ; it is supposed that the calves were at least killed if not eaten, the killing off of the calves being a necessity to prevent their suckling too long. Beef is suggested from the finding of the skull of an urus transfixed by a Neolithic flint weapon. In later periods than the Neolithic, these fine cattle "tossed high their manes of snow" over the whole country, and approached even the gates of London so lately as the year 1174. Their occurrence as wild animals even in the later days of mediæval times is testified to by references in literature. Thus James the First of Scotland in *The Kingis Quhair* writes of "The bugill drawar by his hornis grete," by which, however, he may mean a domestic ox : less doubtful is the line of Dunbar in *The Thrissill and the Rois*, who makes dame Nature order the wild ox thus—

> And lat no bowgle, with his busteous hornis,
> The meik pluch-ox oppress, for all his pryde,
> Bot in the yok go peciable him besyd.

The contrasting of the Bowgle (from Latin *Buculus*) with the meek plough ox is clearly suggestive of a wild form at most imperfectly domesticated. It has been pointed out that wild traits survive in the oxen of Chillingham and elsewhere.

That the bulls are fierce and that it is unwise to go too near them is not of course an argument in this direction, though it is a fact. We know well enough that the most flagrantly domestic bull of the common farmyard is not the beast to tackle from the wrong side of the gate. A feature born of wildness is the way of feeding of the Chillingham cattle. They do not browse openly like an ox of the pasture, but feed as it were by stealth and at night or in the evening. Then, too, the cows when they calve propagate in the

dim obscurities of the wood. The domestic cow realizes that man is a better nurse for her offspring than she herself, and takes no pains to hide her offspring from him. When the herd moves to and fro it moves in the way of wild gregarious animals; the young are placed in the centre and an old and experienced patriarchal bull leads the van. It appears that the name "aurochs," often applied to the European bison, a creature exactly like the American bison, now getting equally rare, but by which the prairies were once blackened, should be retained for the urus; the two names are plainly the same in origin. The *Bos bonasus* of the forests of Lithuania and of the Caucasus should be called by its name of Wisent, which is the same word as bison. It may occasionally be seen at the Zoo. So, too, the American bison and a host of other bovines.

The Lama

The "gawd-forsaken oont" of the East and of Africa is represented in the New World by the lamas, huanacos, alpacas, and vicuñas. These diverse names really apply to only two species of animal. We may term the wild stock of the *Lama huanacos*, huanacos, and the two domesticated forms of the same, lamas and alpacas. The vicuña is a distinct species, *Lama vicugna*. It is unnecessary to anyone who has once seen the beast to inform him that the lama is a camel. It has the same smile compounded of superciliousness, cruelty, and stupidity that characterises its humpy relative of the Old World. It is treacherous and ferocious; and a vindictive male possessed by the Zoological Society was a little bit terrifying as it pursued within its enclosure the steps of the passing visitor and made, fortunately fruitless, endeavours to leap the iron railings that secured the public. For a lama has many weapons of offence when it is really annoyed,

AUROCHS OR WISENT

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and not merely, as Buffon said, the power of spitting. Spitting, it may be observed, is the merest euphemism for what the lama really does do. It ejects the whole contents of its stomach upon the offending one. It will also bite and kick, and can do both effectively. When inclined to be "nasty" it lays back its ears in an equine manner. In spite of this obvious ill-temper, the Chilian naturalist Gay (no relation to the poet and fabulist, though some of his statements would seem to be efforts of the imagination) described the lama in good Castilian as "suave, familiar, timido y muy curioso." This is inadequate. We require more evidence than disposition and outward appearance for the assertion that a lama is a camel. It is a member of the family Camelidæ or group Tylopoda by virtue of the facts that (1) the limbs are not and have not the least trace of the fourth and fifth toes of which rudiments exist in other Artiodactyles; (2) the less complicated nature of the stomach; (3) the presence of incisor teeth in the upper jaw which occupy the place of the callous pad of the ruminants against which the lower incisors bite. There are of course other anatomical facts which separate this group from the remaining Artiodactyles, but the three mentioned will suffice for us. The lama, like the camel, has been, and is, used as a beast of burden. Strings of lamas carried down gold from the mines of Potosi in Peru at the order of the Incas of Peru. The Spaniards when they discovered and conqured Peru thought of introducing the lama into Spain and made efforts in that direction. But apparently the lama will not thrive away from its native mountains. They also provide cloth and mutton and even bezoar stones.

Bezoar stones are concretions found in the stomach, and are thus very analogous to the ambergris of the sperm whale, which is also a biliary concretion. The

true bezards, as they are sometimes called, apparently come from the wild goat *Capra ægagrus*. The use of these stones was the important one that they were believed to be antidotes to poison. In old days, when *aqua tofana* was a more generally used means of inheriting property than now, bezards had a corresponding value. It is said that even so recently as 1847 these antidotes were in use in Chili. The "Allocamelus," as the scholar J. C. Scaliger, and Gesner, following him, called the lama, was a beast which was of course unknown to Europeans until the sixteenth century; the first example as it appears that was ever exhibited in Europe was in 1558. In this year a contemporary woodcut exhibited the lama as a beast of colossal size in accordance with a custom which has not yet and never will die out, of representing anything unknown as large—"omne ignotum pro magno" we might better render a common saying. This specimen came from the "Terra gigantum," by which is undoubtedly meant Patagonia. Others have thought Peru the natural home of the lama, as is claimed by the postal authorities of that explosive republic. Everyone, in this case literally "every schoolboy," knows of the beautiful Peruvian stamps, green in colour and with lamas figured upon them. As a matter of fact, Palæontology seems to show that the lamas sprang into being in the north and wandered over the isthmus of Panama into South America, where they flourished until to to-day, dying out in the less congenial north. A singular fact in the life history of the lama has been commented upon by Mr. W. H. Hudson. It appears that lamas select not exactly burying grounds, but places wherein to die. When a lama feels that it is not much longer for this world, it seeks such a place and turns its face to the wall. In this way piles of bones accumulate; and it may be that "bone beds" of past times which abound

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in the remains of extinct animals were similar cemeteries.

The Camelopard

To term this animal the "camel leopard," as is sometimes done, is a grave misreading of the derivation of the word, which implies of course a combination of the camel and the pard, as Horace says, "Diversum confusa genus panthera camelo." Leopard itself is another such "portmanteau" word. For it in its turn implied a kind of hybrid between the lion and the pard. To the ancients such monsters were not incredible. We know that animals so remote will not breed together. The Romans apparently first knew the giraffe from examples exhibited in the days of Julius Cæsar. Pliny, who is responsible for this piece of information, also thought the giraffe as mild as a sheep in disposition. It is rather timid and nervous than mild. The least surprise frightens it greatly; and the late Mr. A. D. Bartlett informed the present writer that he never thought of suddenly appearing in the giraffe house without giving previous warning by shuffling of feet and other less terrifying and introductory noises, lest the giraffes should bolt and break their legs. It is not mild, for it will kick and try to bite. At one time the Zoological Society were as successful in breeding giraffe as the Dublin Zoo are now in breeding lions. In 1836 the first specimens arrived at the Zoo at five o'clock in the morning, as witnessed by the late Sir Richard Owen. They were conducted thither from Blackwall by M. Thibaud and four Africans "in native costume," and for about sixty years the stock of giraffes derived from these and from others acquired subsequently flourished exceedingly. Then they died out, and the Mahdi appeared upon the scenes, effectually preventing for some time the importation of other

specimens, as Khartoum was the centre of the animal trade in the part of Africa whence giraffes were generally acquired. Now there are prospects of a further continuation of the giraffe stock.

The giraffe has an aspect which is so familiar as to need no special description. But a few points must be referred to as marking its rather isolated position in the Ungulate series. There is in the first place no manner of doubt that it belongs to the deer-antelope section, the Artiodactyla, as evinced by its paired hoofs and by its complex ruminating stomach. The horns, however, are of a different kind to those of other Artiodactyles, except the newly discovered ocapi, which is of course a short necked giraffe, to speak crudely. The horns are in all as many as five, of which one is median and unpaired. The others are paired and as a rule only one pair is very distinct. These horns are bony prominences in the adult animal which are covered with quite unaltered skin. They are not shed.

The lengthy neck is interesting as illustrating the permanence of type in animal structure. It might be supposed that the neck of the giraffe and that of the hippopotamus, to take two of the greatest contrasts in neck that occur among mammals, were lengthened or shortened by the omission or addition of vertebræ. But nothing of the sort occurs. The giraffe's long neck is produced by a pulling out of each individual vertebra while the same are shortened in the hippopotamus. In both beasts, as in nearly all mammals, there are but seven of these neck bones. Its spots and length of neck are said to advantage the giraffe greatly in the "struggle for existence." The spots, at first sight appearing to render it particularly obvious to any marauding lion or leopard, are said by those who have come into view of the giraffe in its own forests, to absolutely aid in hiding it. The spots,

GIRAFFE

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in fact, break up the large body into less conspicuous patches. As for the long neck, its presence has been interpreted in two ways. On the one hand it is suggested that length of neck is favourable to the cropping of the branches of high trees; on the other, the head perched upon so high a look-out tower enables the animal to keep a wary gaze upon the surrounding neighbourhood. It is remarkable that in two African animals, the ostrich and the giraffe, and to a less extent in an antelope (*Lithocranius*), which all frequent grassy country with scattered bushes, the same elongation of the neck occurs. Giraffes seem to be divisible into two well marked varieties. But so few individuals comparatively speaking have been examined that it is a little dangerous to assert that these are constant species. In the northern form the red brown blotches are sharply marked off at their edges, so that the white bands are equally conspicuous and divide the skin in a reticulate fashion. This kind of giraffe has, moreover, a particularly well developed median unpaired horn. In the southern form the median horn is a low elevation, and the demarcation between the brown and white is not so sharply marked, so that the animal is blotched rather than reticulate. Other varieties have been named.

The Elephant

The elephants are a dwindling race in numbers, though hardly indeed in size. At the present day there are but two different species, the African and the Indian. In former periods of the earth's history there were large numbers of different kinds with a much more extensive range. Several of these lived in England. Nowadays the elephant is a purely tropical beast. Apart from the resident staff, the elephant is the only creature at the Gardens which stands up resolutely

and upright upon its pillar-like legs. In other beasts there is a bend, or there are bends, in the limbs between their origin from the trunk and their implantation upon earth. The elephant is also the only living ungulate animal, except the hyrax, which has retained many toes. In other ungulates one or more have disappeared upon both hind and fore limbs. Its scanty covering of hair betrays the ungulate as does also the thick skin. The elephant is as pachydermatous as the rhinoceros. Though divested for the most part of a hairy covering, the newly born elephant is much more liberally provided with hair, a fact which recalls the mammoth of antiquity. That the trunk is an essential of an elephant everyone knows, though it is not a matter of universal knowledge that this organ is merely the prolonged snout plus the upper lip. Hence it is not merely a long nose as caricaturists would sometimes have us believe. The nostrils are at the end of this lithe trunk, which is also a tactile and prehensile organ of value to its possessor. The tusks are of course the principal cause of the commencing rarity of the elephant, particularly the African species. They are really great persistent incisor teeth, entirely comparable to those of rodents, since they grow perpetually through the life of the animal. The Chinese have a legend concerning the fossil ivory met with in northern Asia, that the teeth are the remains of a gigantic and underground rat. The legend has so far a basis in truth that the long and persistently growing teeth of the two animals are the same kind of teeth. The two kinds of elephants are always to be seen at the Zoo. The notorious Jumbo and his helpmeet Alice were African elephants, which grow to rather a larger size, and are to a certain extent a more primitive type of elephant, than the Eastern form; they range from India through some of the larger islands of the Malay

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archipelago. The African elephant has a retreating forehead which contrasts with the wise and bulbous forehead of the Indian beast furrowed in the middle. The trunk has two finger-like tips at the end. The ears are enormous and flap back over the shoulders.

The Indian elephant is really, relatively speaking, of course, a small-eared elephant. Within its extremely thick skull lies concealed a brain, which is reputed in the elephant tribe to be particularly effective as a brain. As a matter of fact elephant stories have suffered both from exaggeration and inaccuracy. It is always tempting to read into the actions of an animal purely human motives. Revenge seems to be as sweet to elephants as to women, and tales are told of the nursing of wrath through long periods. Judged by the numerous specimens at the Zoo, the intelligence of the elephant does not appear to be much superior to that of many other beasts. Ungulates generally are not remarkable for brain power, and all that is done by an elephant in obedience to the mahout is also done by trained horses at a circus. As to longevity, that too has been exaggerated vastly. Probably after all Aristotle was not far out when he assigned 200 years as the utmost limit. Long before the Zoo existed, in fact so far back as 1257, an elephant was exhibited in the Tower Menagerie, a royal foundation which as will be seen antedated the Zoo by some centuries. The Zoological Society possess in their house in Hanover Square a quaint cut of an elephant exhibited in the sixteen hundreds. The elephants at the Zoo are, as is well known, used for riding purposes. Their gait under those circumstances is not fast, neither can the elephant ever go at a really fast pace. It has shuffling movement which is incompatible with swiftness.

A PRIMITIVE UNGULATE

The Coney or Dasje

The name coney is familiar enough, principally because it occurs in the Psalms: but Dasje is not so familiar, and when made use of is usually and inaccurately spelt "dassie." The word in fact is analogous to "kopje," about which we used to hear so much a few years ago, and is a diminutive, in this case from a word signifying badger. Neither coney nor dasje is at all indicative of the real nature of this most interesting animal, *Hyrax* (or *Procavia*) *capensis*. It has nothing whatever to do with either rabbits or badgers; and is in fact, an ungulate animal not directly related to any living form nor indeed, so far as present knowledge leads, to any extinct form, but none the less a true ungulate. Even its outward form, when rightly considered, betrays the ungulate. The nails on the feet are rather hoofs than claws; the fingers and toes are reduced to four on the front limbs and three on the hind limbs, such a reduction being a common feature of the ungulata. The scalpel at once settles the point. For there is no collar bone, and a portion of the shoulder blade known as the acromion is absent, while the molar teeth have a pattern which is decidedly like that of the rhinoceros. They have, however, undoubtedly a likeness to rodents. To this contributes the small size (for modern ungulates are unusually big), the much reduced tail, and the squatting attitude generally adopted. So impressed was de Buffon with these matters that he wrote of the hyrax under the name of "Marmotte du Cap." As the Psalmist rightly says, "The high hills are a refuge for the wild goats and the rocks for the coneys." This is, doubtless, one of the earliest allusions to the coney. They are spoken of, as everyone knows, in other parts of the Scriptures as "a feeble folk," though "exceeding wise." But to

say that the hyrax "cheweth the cud but divideth not the hoof" is clearly incorrect. Canon Tristram, however, has ingeniously explained the latter statement by pointing out that these animals have a habit of working the jaws about which might have given rise to the idea. One of the earliest of African explorers, Bruce, kept a coney to see if it did chew the cud, and came to the conclusion that it really did! Coneys are only found in Africa, and in some parts of Arabia and Palestine. As a rule they prefer rocks and stones as an environment; but some are arboreal, and the special name of *Dendrohyrax* has been applied to these climbing coneys. When on the ground the dasjes lurk in crannies and cracks and clefts, not building for themselves any habitation. The traveller Bruce did not only distinguish himself by the inaccurate observation just referred to; he noted that the animal, which he described under the Abyssinian name of Askoko, could climb inaccessible cliffs by merely hanging on like a fly on a wall, and came at least very near the truth in his explanation of the singular phenomenon in the life of so comparatively speaking heavy a mammal. It will be noted from an examination of the live animal at the Zoo that the soles of the feet are fleshy, and that the fleshy part extends beyond the hoofs in front. Coupled with this are creases and folds on the lower surface and a great abundance of sweat glands, which are stated to be fifteen times as numerous as those upon the sole of the human foot. The lubricated under surface of the feet, aided by the contractions of suitable muscles, allow of the foot being closely approximated to a smooth rocky surface, or to an angular one, and atmospheric pressure does the rest, as in the case of the foot of the gecko. The under surface of the foot is simply resolved into a series of suckers like those upon the arms of the cuttle-fish.

THE MANATEE

The Sirenia or Manatees and Dugongs

The dugongs and manatees are the only mammals, save the cetacea, which possess paddles instead of ambulatory fore limbs, and in which the hind limbs have disappeared —that is to say which possess this combination of characters, for the seals and sea lions may be fairly said to move by paddles. They can be readily distinguished from the whales and dolphins by their much less markedly fishlike aspect; the skeleton and anatomy generally is indicative of a beast which has more recently taken to the purely aquatic life than have the whales. Dr. Semon truly remarked of the dugong, that it appeared to the eye "more fishlike than seals, and more mammal-like than whales." The hairy covering of the body has entirely disappeared in whales save for a few hairs upon the snout in some cases. In the Sirenia, though the body is practically naked, there are yet traces here and there over the general body surface of hairs. Besides the manatee and the dugong there was, until the close of the eighteenth century, a huge thirty foot long sirenian known as *Rhytina* upon the shores of Behring's straits.

The Manatee

The fact that on the rare occasions when a manatee is exhibited in the gardens it is accommodated in the reptile house is no slur upon its Zoological position, but only due to the necessity of providing for a tropical animal a tropical temperature. The manatee, aquatic and "finned" though it is, is a mammal, and belongs to an order which has been called with unnecessary poetry the Sirenia. The name embodies, however, the legend that these creatures are responsible for the origin of the Sirens. The manatee—and still more its Eastern ally the dugong—though by no means "mulier formosa superne," undoubtedly "desinit in

piscem." The tail is quite fishlike, especially the forked tail of the dugong, and the hind limbs being absent the resemblance is heightened. The corresponding legends of beautiful and marine maidens in temperate climes must be mothered upon seals. Indeed the amount of " combing " done by the seal with the aid of its flippers is possibly the explanation of the invariable possession of a comb by a mermaid. The looking-glass is not so easy to account for. The manatee is a black-coloured animal with but little hair on the body, and with a pair of flippers which bear no nails in a form that has been on two occasions exhibited at the Zoo, and which on that very account is known to zoologists as *Manatus inunguis*. The hind limbs have gone save for rudiments beneath the skin. There is no beauty in its countenance ; this is hindered by a curiously split upper lip, which allows the animal to manipulate its vegetable food, which it crops in submarine pastures. " Merpig " would be really a more suitable name for this creature, as it undoubtedly comes nearer to the ungulates than to any existing group of mammals. It has not, it is true, " the inn'ards of a Christian," which for some reason or other the pig is regarded as possessing. Its stomach is perhaps more like that of a cow, inasmuch as it is complicated by division into several chambers, as is indeed not infrequent in vegetable feeding animals. The chief internal feature of the manatee is its huge lungs, which perhaps are " contrived a double debt to pay "—lungs when above, and a swimming bladder when below the water. The manatee has no engaging ways and tricks to attract the visitor ; it simply grazes with bovine stolidity.

The Carnivora or Flesh-eating Mammals

It is hardly possible to mistake the members of this order of the mammalia. Their claws are sharp and

compressed, not at all like hoofs or nails, though, of course, all these structures are absolutely of the same essential nature, and even intergrade in some groups. This character alone is, however, not sufficient to distinguish the carnivora. Various rodents and insectivores possess claws which are more or less sharp. But no rodent possesses what the carnivora always possess, and that is long and strong canine teeth for seizing their living prey. Here again is a character which does not, in conjunction even with the last, absolutely mark off the carnivora from all other mammals, for the insectivora possess the same canines, which are in many cases quite as strongly developed as in the carnivora. By two external characters it is always possible to distinguish between carnivora and insectivora, though the otter-like insectivorous creature, the West African *Potamogale*, is very "carnivorous" in appearance, and only possesses one of these characters, and that in not a very marked degree. In the insectivora the upper jaw and nose projects as a rule beyond the lower, and thus forms a kind of proboscis. Again, the skin of the insectivorous mammal has a distinct tendency to run to spines. No carnivore has a proboscis, and none are at all spiny. Finally, while the insectivora are all small, and often quite small, the carnivora are, with the exception of the weasel, at least moderate-sized, and often rather big, as is the case with bears, lions, and tigers. There is at least one obvious internal character which absolutely distinguishes all the living members of the two orders. The carnivora have a better developed brain than the insectivora; indeed, in the latter it is at a very low ebb, being almost smooth, and the cerebral hemispheres are small.

Now that we have got at a definition of the carnivora, which includes all of the diverse animals which constitute the order, it will be necessary to consider their

characters a little more in detail. In the first place we must distinguish two kinds of carnivora : there are the land forms, the tiger, bears, raccoons, weasels, and so forth ; and secondly, there is the remarkable group of the seals, sea lions, and walrus. The latter are purely aquatic creatures, with feet converted, so to speak, into fins by the aid of which they can swim, and are on that account termed pinnipedia ; the land forms have been called by the corresponding name of Fissipedia. The former group is dealt with later under the heading "Sea Lion." As to the land carnivora, the Zoological Gardens always contain a large assortment of various forms. The land carnivora are spread all over the world, with the exception of New Zealand, and are chiefly to be found in the tropics of both worlds. Strictly perhaps we ought to except Australia from the list of those countries which contain carnivora, for the only representative of the order occurring therein is the dingo dog, concerning whose origin and habitation of Australia there is some dispute. It has been held that that dog is not an indigene, but has accompanied the black man in his travels. The carnivora are somewhat diversified in their habits, as is natural with so extensive a group. There are, in the first place, purely slaying and killing carnivora, such as the lion, tiger, leopard, jaguar, cheetah, and several cats. These are solitary, or at times go about in families. The pack-hunting wolves, more entirely ground living than the cat tribe, form another assemblage. But while many carnivores live largely in trees, there is no type known which has become modified in the direction of "flight," such as is seen among the arboreal rodents and marsupials. Nor is there any underground Carnivora. The aquatic forms among the usually terrestrial fissipeda are not very many. We have the otters of our own rivers, and those of other parts of the

world ; and there is even an otter (*Enhydris*) which lives by the sea shore, and makes excursions therein for its food, a way of life which is occasionally copied by the usually fluviatile otters of the genus *Lutra*. Bears and the bear tribe generally are not as a rule so purely carnivorous as the cats ; some of them, however, such as the weasels and stoats and the South American tayra, are as bloodthirsty as the fiercest of cats.

Apart from fossil forms, which tend to fill up gaps and destroy clear and sharply cut classifications, the carnivora are separable into three divisions, all of which are abundantly in evidence at the Zoo at any time. We have, first of all, *the* carnivora *par excellence*, in which the carnivorous type of structure has arrived at the greatest perfection and specialization—that is the Aeluroidea, or cats and civets. These animals are generally spotted or striped, or both. The civets are on the whole, less specialized than are the more fully developed cats. Their claws are not so retractile, or are not so at all : they are all smaller beasts than the true cats, which include such giants as the lion and tiger. The civet tribe includes not only the civets and genets, but also the little African suricates, which sit up on their hind quarters like prairie dogs, the curious slothful binturong, and a variety of forms known as palm civets, of all of which, as well as of a few other forms mentioned in the ensuing pages, examples are to be seen in the Zoo. The hyænas, including the *Proteles*, are another branch of the Aeluroidea. The second great division of the fissipede carnivora is that of the dogs, which includes the large number of wolves, foxes, and jackals, of which again a comprehensive assortment is invariably to be seen in the dog-kennels near to the lion house. These have not retractile claws, but they walk, like the cat tribe generally, upon their toes, and not upon the soles of the feet.

Neither these nor the remaining section of the carnivora, the great tribe of Arctoidea, are prevalently spotted or striped in coloration. The Arctoidea include not only the true bears, of which the European bear, the grizzly, the Syrian bear, and the polar bear, as well as some others inhabit the bear dens in plenty, but a variety of small creatures, which are referable to two distinct families, the mustelidœ and the procyonidœ. The former contains not only the weasels and stoats and polecats, but also the badgers, glutton, the American grison and tayra, the martens and sables, the ratel with its grey back, black under-surface and hurried walk, the skunk or " essence pedlar " of North and South America, and the otters. The procyonidæ is a family made for the reception of the raccoons, the prehensile-tailed kinkajou, also of South America, the coati with its pig-like snout and ringed tail, and the panda of the Himalayas. The Arctoidea are less decisively Carnivora than the Aeluroidea or Cynoidea. The teeth are largely flat-crowned, and suitable for crushing rather than tearing, a fact which goes, as has been already said, with an often principally vegetable diet ; they walk upon the soles of their feet instead of upon the toes, and there are other anatomical characters, which show that the group is one which is, so far as the living representatives are concerned, to be sharply marked off from other carnivora.

The Lion

We have constantly met with persons who have the impression that while the tiger is an undoubted cat, the lion has more of the dog nature. This quite erroneous idea is probably to be traced to the mane, and to the certainly leonine but also almost Newfoundland-dog-like head. The lion, however, is quite a diagrammatic cat, with the usual retractile claws,

and the sharp, long and strong canines of that eminently carnivorous race. Much legend and many mis-statements have clustered round a little bit of hard and horny skin at the end of the lion's tail. It has been said to lash itself into a fury by means of this "nail." The lion is now Asiatic and African in its habitat: but within the historic period it inhabited Europe as far west at any rate as Greece. Hercules and the Nemean lion, of course, hardly prove this; but there are more historical accounts. Even now it seems to occur so near to Europe as the eastern confines of Asia Minor, which after all is, so far as its animals are concerned, Asiatic by courtesy. The so-called maneless lion of Gujerat seems to be a myth in one sense; that is to say, there are doubtless maneless lions in Asia, but they are young ones. Painters and poets have largely caused the respect in which the lion is held as the king of beasts. In Africa a different view is officially held, and it is legally "vermin." The roar of the lion is not unimpressive in the lion house, where echoes add to its apparent volume. The lion howls in concert like any nocturnal cat. Opinions seem to differ as to the majestic tones of this kingly caterwauling in a state of nature. Livingstone thought but little of the lion's roar, but Mr. Selous thinks that there is no more magnificent sound in nature. The lion does not appear to be so considerate to the jackal as fable would have us believe. Those who know the lion and his ways assert that he has an unkingly love of carrion, and that the dead body of an elephant has more allurements for him than the finest herd of zebras or antelope. There are constantly lion cubs born at the Zoo, but it is an odd thing that they generally suffer from cleft palate, which does not, of course, conduce to their longevity. The young lion seems to be born with its eyes open, unlike the kitten. It is notorious that the

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Zoo at Dublin has been for years famed as a manufactory of lions, which breed with the greatest success. Even in travelling menageries the same success has been attained, which is, to say the least of it, unexpected. It is unnecessary to say that the visitor will find at least half a dozen lions at any given time in the Zoo.

The Tiger

The tiger (*Felis tigris*) is undoubtedly the largest of living cats, and even equals the great cave lion and the sabre tooths of antiquity. It shows what is rare among cats, transverse striping instead of spots; and so firmly fixed in the tiger race is this plan of colour that the newly born young show the same striping as their parents. Often, as has been pointed out in the case of the puma, the young of the carnivora show a different mode of coloration to that of their parents. A careful study of the stripes of the tiger shows that they are not so remote from the prevailing feline spotting as might appear at first sight. In many cases the bar has a white or rather tawny centre, and thus suggests a large spot pulled out lengthwise. The colour of the Royal Bengal tiger is so very well known that it needs no further comment. But there is one point of some little interest to which comparatively little attention has been paid. When the tiger is sleeping with its head on its front paws, and its ears turned rather forwards, it will be observed that there is a bright white spot, with a black rim upon each ear. The effect of this is to give the sleeping beast a look of alertness, for the spots are not unsuggestive of eyes. The common cat has something of the same kind, which has been often referred to, and has been also figured. When the eyes are closed the arrangement of the pattern of colour above them gives the impression of a watchful and

unwinking eye. It is possible that these contrivances have a value to the beast, and prevent some molestation. "The fery tigere full of felonye" has a purely Asiatic range, and, like the puma, is indifferent to heat or to cold. But in the north it puts on a thicker coat.

It is a good swimmer, and regularly crosses over the strait to Singapore; it swims the Amur in northern Asia, and there are thus but few obstacles to its roaming. It is strong above all carnivorous beasts of the field. A big tiger, it is alleged, can seize a bullock and chuck him ten or fifteen yards as can a terrier a rat. But it is only proper to observe that this is ridiculed by Sir Samuel Baker. It growls "like a waggon going fast over a wooden bridge," and has also a somewhat plaintive cry, a kind of querulous mew, generally to be heard in the lion house at the Zoo. The tiger in India almost takes the place of the wolf in this country. Just as we have Wolverton, Wolfslee, and other names associated with the name of the canine carnivore, so in India are analogous equivalents of tiger town, and so forth, commemorating the huge Asiatic feline. Moreover, in this country there were werewolves, men who had changed into wolves; in India the tiger has given rise to exactly the same kind of legend.

The Puma

Like the lion, the eyra, a lean somewhat mongoose-like cat, and the caracal, the puma is what is called "self-coloured": that is, it is of uniform colour more or less throughout. It is tawny, tending to brown or grey at the two extremes, and whiter below. Its young, however, are as spotted as any pard, and would not be thought to be of puma parentage by any one who was ignorant of the fact and shown the skins. This would appear to argue that the puma, desert coloured though it is at the present day, has descended

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from a type following the more prevailing cat fashion. The puma is limited to America, and, like the tiger, it can bear with impunity the extremes of heat and cold ; it is at home in the wintry north, and lurks in the damp and heated forests of the south. The puma has the usual intent look of the feline race, and has the reputation of being a mild and peaceful animal where man is concerned. It is held to be as innocuous to the weaned child as is the cockatrice, and has even been called, according to Mr. Hudson, " amigo del cristiano." But it is a ferocious beast where deer, domestic animals and vizcachas are concerned. Ineffective as its lithe form would appear to be for any purpose save swift running, it can leap upon a deer and break its neck with the ease of heavier beasts, like the tiger. To most naturalists, at any rate in Europe, there is but one puma, *Felis concolor*. But in America there are different opinions, and the pumas have been split up into a considerable number of races, or even distinct species. In the south of the United States the puma is spoken of as the mountain lion. Another name is the native " Indian " cougar. The name of " lion " appears to have, or at least to have had, a certain amount of justification. It is not, as might be thought, derived from the loose application of a word in common use to anything that it might or might not fit ; but the first Europeans who examined the puma thought that they had before them merely the maneless females, and came to the conclusion that the ferocious males were not to be caught or slain by the comparatively unarmed natives. If anything were wanting to prove the cat-like nature of the puma, the fact that it purrs in captivity when pleased, and even utters a sound approaching to a mew, would settle the matter to the satisfaction of everybody. In nature the cries of the puma are weird and mournful. But it is on the

whole a silent animal. With an absence of prejudice befitting so great a naturalist, Darwin banqueted off puma during his travels, and found it excellent. Even in this country canine teeth have been recorded from what bore the name of jugged hare, and was at least a dark-coloured and well-flavoured viand.

The Leopard

Panther and leopard, or pard, are really quite synonymous. But that mighty hunter, the late Sir Samuel Baker, proposed to restrict the use of the name "panther" to leopards of seven feet and upwards in length. The leopard is Asiatic and African in range. It is a perfectly typical cat, and, like so many others, spotted. The nature of the spots enables the leopard to be distinguished at once from the South American jaguar, to which it bears not a little resemblance, though it is true that the latter, being a more perfectly arboreal animal, has shorter legs. The spots in the leopard are in the form of rings of black, where best developed, the centre of the ring being of the same tawny ground colour as the intervals between the spots. In the jaguar the ring-like markings enclose a central black spot. The spotting has been thought by an ingenious speculator in zoology to be a vestige of a former armoured condition. He held that the spotted carnivora were the immediate descendants of creatures with heavy plates imbedded in the skin, like an armadillo or a glyptodon. The last trace of these was to be seen in the black spotting of to-day. But there is really very little to be said for this view. The leopard, like so many other animals, shows at times the phenomenon known as "melanism." That is, the colouring is so generally darkened as to produce blackness. These black leopards have the reputation of greater ferocity than their paler brethren. Melanic

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leopards are said to be most common in damp and hot localities, such as the steaming forests of the Malay peninsula. Even then the leopard does not entirely change its spots, for in the proper light the spots can be recognized by their pattern, just as the pattern of a white damask tablecloth can be recognized in spite of the absence of differentiation of colour. The ancients held that the leopard had a fragrant breath, which is unexpected in so carnivorous a creature. The idea not only crops up in Pliny, whose works are a heap of confusion, where anything in the nature of legend may be shot and subsequently utilized, but in an Anglo-Saxon poem. Even Dryden was not above the naturalists of antiquity in this belief. "The pantere like unto the smaragdyne" seems to be an equally inept description of this cat, unless indeed the eyes alone are referred to.

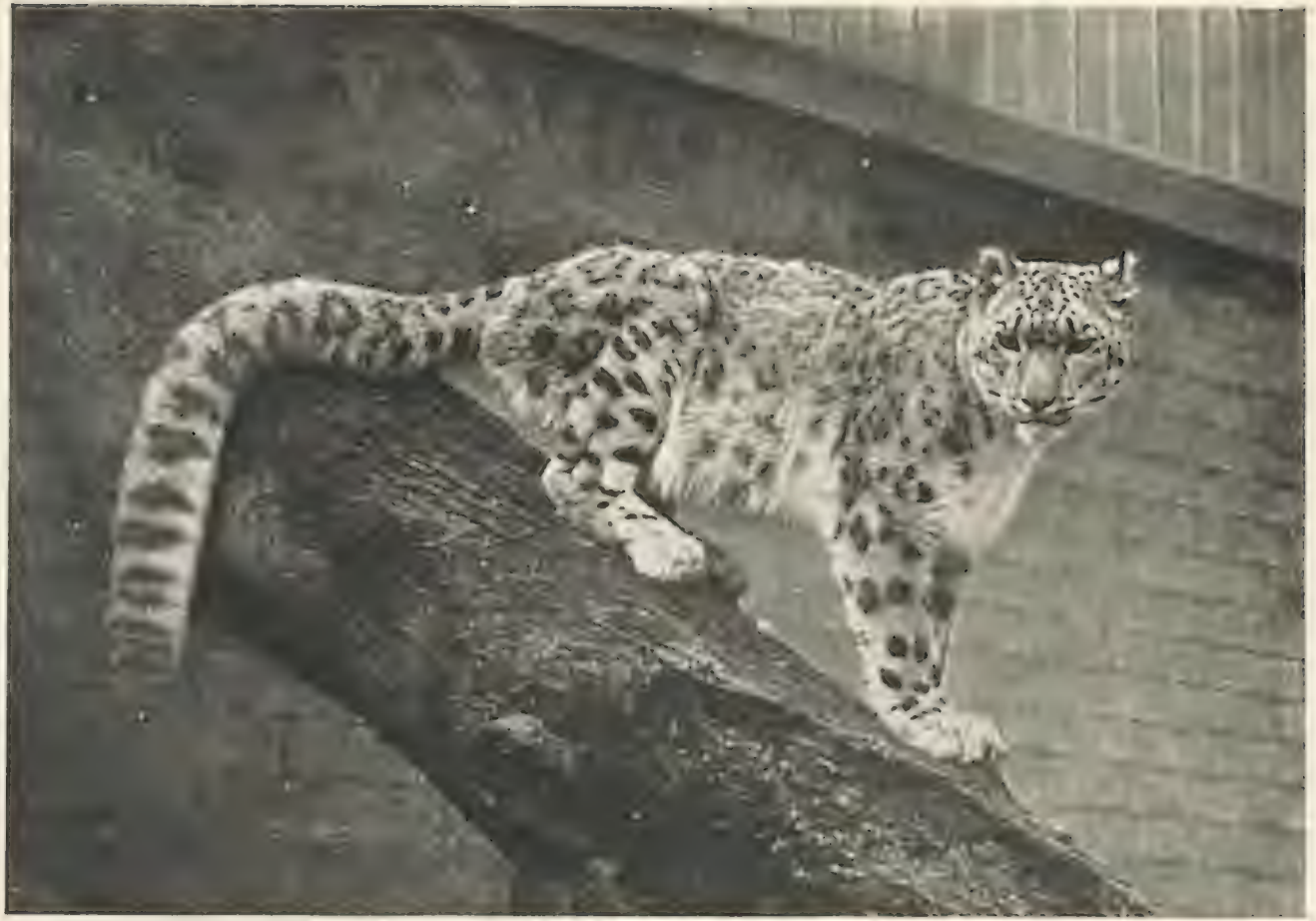
The Snow Leopard or Ounce

It is only rarely that this beautiful feline has been on view at the Zoo. In fact until very recently it was quite unknown in that collection. Since then, however, there have been several examples. The ounce is not, as it might be thought to be, simply a pale and rather woolly variety of the common leopard. It is a perfectly distinct form, and is limited to Thibet and the highlands of Central Asia, like the kiang. It is certainly of a furry aspect, as is also the kiang, and as befits an inhabitant of a cold climate. The skin has a paler ground colour than in the leopard, and is sprinkled over with spots, which are rather less defined. The tail is particularly thick and long, and this indeed is the most obvious character of the beast. The tail is so long that it is actually longer than the head and body together in some, though not in all, specimens that have been carefully measured.

In its native mountains the ounce attacks wild sheep and goats, and it prefers, like its prey, lofty altitudes. The cat is usually found at such heights as 9,000 feet, but in winter descends rather lower. Like the puma, but unlike its nearer relative the leopard, the ounce apparently will not fall foul of man. At any rate there appears to be no positive record of its ever having done so. In the Caucasus dwells a leopard-like creature which has been confounded with the ounce. But it has been shown that the "leopard" of the Caucasus is a true leopard, though differing a good deal from the African and Indian beasts. Its paleness of hue approaches that of the ounce, but it is not so pronounced. *Felis tulliana*, as it is called, is apparently a "good" species of leopard, and is not the same as *Felis uncia*.

The Wild Cat

Felis catus of Britain and Europe generally is one of those creatures which are distinctly on the wane; that is to say, so far as concerns this country. On the Continent in wild forests, such as those of Transylvania and in many parts of Europe, the wild cat still lives and multiplies. A defunct one floating down the River Adige allowed a witty onlooker to term it the "poor cat i' the adage." In Regent's Park the cats chiefly observable are kept for the purpose of thinning the rats and mice which revel there in unaccustomed plenty, and do not belong to *Felis catus*, as some people still think. The genuine wild cat, however, with which we are here concerned is often on view in the Zoo. There was until lately a fine one, presented by that eminent zoological observer, the late Lord Lilford. This cat spoke at times, and with no uncertain sound; its loudness was indisputable, and an excellent sympathizer with beasts who wrote in the



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Saturday Review thought that he was able to interpret its utterance as a protest against captivity. What was proved, however, is the power of caterwauling in a voice not inferior in variety of tones to that of domestic pussy. To the casual onlooker the true wild cat of Europe does not differ widely from many specimens of domestic cats. It is difficult, indeed, to distinguish with absolute certainty some so-called domestic cats from a genuine wild specimen. This does not in the least prove that the tame cat and the wild cat are the same speices ; that idea admits of disproof, which we shall set forth presently. What it undoubtedly does prove is the close interbreeding for many generations of the two stocks. So intertwined nowadays are the two races that it is better to speak of both, and not limit ourselves to one. As to the real wild cat, it has been extinct in England since, at any rate, 1843 ; indeed, some put its final disappearance much earlier. The late Rev. H. A. Macpherson considered that historical evidence placed the death of the last wild cat in the Lake district, which would naturally have harboured cats for a longer period than more cultivated tracts, as long ago as 1754. Pennant, so well known as the correspondent of Gilbert White, termed the animal the "British tiger," a name well earned by its ferocity, and perhaps by its size relative to the domestic cat. The amount of spitting and swearing which will probably greet a prolonged attention to a caged cat at the Zoo, will amply bear out the justice of Pennant's name. Not an atom of white hair is ever to be found about the true wild cat ; but other positive differences, owing to the repeated crossings already referred to, are practically wanting.

It may be asked, however, how it is that if cats have been common in this country in the past though rare now, our domestic variety is not an offshoot from

Felis catus. It may seem to some so elaborate a divergence from obviousness to seek a foreign origin for a beast so exactly like a wild creature actually inhabiting these islands. The proof is largely antiquarian in its nature. If wild cats were really domesticated, how is it that we hear so little about them in the past; and how is it that when legend or history does tell us anything, it is to emphasize their scarcity and value. Witness, for example, the story of Dick Whittington. His cat brought him a fortune. The very name "puss" is an indication of exotic origin. Some think it is an abbreviation of "Persian," and that in consequence we are to look upon Persia as the ancestral home of our fireside friends. Not so thinks the author of that most readable work, *Gleanings from the Natural History of the Ancients*. For Mr. Watson the name is a corruption of Bubastis or Pasht, and suggests an Egyptian origin, which fits in well with the habitat of a wild cat *Felis maniculata*, and with the probable course of civilization and cats from Egypt along the Mediterranean to these shores of ours. Perhaps the "poor cat" who "amat pisces, sed not vult tingere plantas," has retained its dread of water from a previous dwelling in a hot, sandy, and waterless desert. That there is no inherent dislike of water in the cat tribe is clearly shown by the fact that the tiger will swim across the river Amur in its northward wanderings, and to the island of Hong Kong in search of pigs, or perhaps coolies, while the East harbours also a carnivore which is actually known from its habitats as the "Fishing cat." That the domestic cat has not been long "civilized," relatively speaking, is shown by its retention of many of the habits of a wild animal. An able and ingenious writer, Dr. Louis Robinson, has lately discerned in the ways of tabbies many such traits. The fondness for sleeping coiled up and on an exposed

though often remote situation suggests a fear of enemies, and also a kind of imitation of the serpent. To imitate a serpent, however, seems to be needless. If there is anything in the world sharper than a serpent's tooth it is a cat's claw. A wild cat can look after itself without, so to speak, borrowing from the attitudes of the serpent, and endeavouring to delude its foes into the notion that they are to deal with the "vengeful snake." Still, the aloofness of pussy is probably a trait of wildness, as is her frequent habit of escaping for weeks from comfort, and leading a wild and hunting life in neighbouring game preserves.

Cryptoprocta ferox

About twice the size of a common cat with a long tail and of an uniform sandy or tawny hue, is the Fossa of Madagascar, an island which does not nourish many bloodthirsty beasts of prey. It appears, however, that what it wants in quantity it makes up for in quality; for the *Cryptoprocta*, as its specific name suggests, is reputed to be one of the most ferocious of hunting mammals. The unprejudiced visitor to the Zoo will probably not be of that opinion. For the specimens that have been on view at that institution present the appearance of mildness rather than ferocity of disposition. But place a *Cryptoprocta* handy to a farmyard and the bloodthirstiness comes into evidence; it will kill and slay indefinitely. In this it is like its not near relative the weasel, ferocity of disposition being often in wild beasts disproportionate to size. This fossa must not be confounded with another Madagascar carnivorous animal, *Fossa daubentoni*, which is more definitely a civet, though lacking the odoriferous pouch of those beasts. To avoid confusion the latter animal is spoken of as the fossane. The exact position which *Cryptoprocta* occupies in the carnivorous

series is a matter of some dispute. There is no doubt, of course, that it belongs the the Aeluroid or cat-like division of that tribe; but there are those who dwell upon its civet-like features, while others urge its greater likeness to the true cats of the family Felidæ. A third opinion remains, which is that *Cryptoprocta* is a slightly altered descendant of the creodonta, an extinct race of carnivorous mammals from which possibly all the existing groups have been derived. The fossa has the retractible claws of the cats, coupled with an almost plantigrade gait; the latter quality, of course, not cat-like, but a point of resemblance to the Viverridæ, or civets. The tawny colour of the *Cryptoprocta* cannot be put down, like that of the lion, to a fondness for a desert environment. And cases like this raise a doubt as to how far colour in such instances is the result of an adaptation to natural surroundings. Apparently nothing is known of the new-born young of the *Cryptoprocta*. It will be noticed that the fossa has the normal number of five toes upon each limb, and that it has the elongated muzzle of the viverrines, and not the shortened face of the much modified cats.

The Mungoose

The mungoose (the name is a corruption of a "native" word, and has of course nothing to do with "goose") is rather interesting on account of what it does than what it is. It is, as a matter of fact, one of the Viverridæ, or civets, the apparently more archaic relations of the cats. It has the primitive character that many of the viverrids have of five toes on each hand and foot. The feet are moreover plantigrade and the claws are not retractile into sheaths as they are in all true cats, belonging, that is to say, to the genus *Felis*. The colour is usually a speckled "pepper and salt"; but the hues vary according to the species, of which this genus

Herpestes contains about twenty. The mungoose is *Herpestes ichneumon* ; and the beast is often spoken of as the ichneumon. It has been also called, the Cat of Pharaoh, and also by a somewhat remarkable change the mouse of Pharaoh. It is found in northern Africa, in Palestine and Asia Minor, and creeps into Spain.

The mungoose is cat-like in its pursuit of rats and mice, but nothing comes amiss to it in the way of animal life. Buffon remarks that " its courage is equal to the sharpness of its appetite, being neither intimidated by the anger of the dog, nor the malice of the cat "—an excellent distinction between the characters of those carnivores. The mungoose shares with the secretary vulture, the hedgehog, and the pig, some immunity against the bite of venomous serpents. But it is not so certain whether the immunity is not more due to the activity of the creature is escaping the strokes of its enemy than to any subtle physiological character. In any case mungooses have been imported into Sta. Lucia for the purpose of confronting the deadly Fer de Lance. Legend holds that if the ichneumon is bitten it immediately runs off, and eats the leaf of a particular plant. It was thought also by the ancients that the animal covered itself before engaging in these encounters with a coat of mud, so as to render itself impervious to the vengeful snake. The Rev. Mr. Topsell related in the sixteenth century the story of these combats. " When the aspe espyeth her threatening rage, presently turning about her taile, provoketh the ichneumon to combate, and with an open mouth and lofty head doth enter the list, to her own perdition. For the ichneumon being nothing afraid of this great bravado, receiveth the encounter, and taking the head of the aspe in his mouth biteth that off." The introduction of these creatures into the West Indies was no doubt useful in the slaughter of a few trigonocephali, and more rats, but the carnivore

developed a taste for the hen-roosts and the last stage of the island was worse than the first. It is ever thus when we attempt to interfere with the due course of Nature.

The Aard Wolf

The aard wolf, *Proteles cristatus*, is one of the scarcer visitors to the Zoo, only two examples altogether having been exhibited there. The animal is hyæna-like in aspect, and is in fact a kind of weakened and slightly degenerate hyæna. The huge teeth of the latter which can crack a marrow bone as easily as a man will a nut, are dwindled into tiny and inefficacious organs of mastication. But it is striped like one species of hyæna, and has a mane like that cowardly and yet ferocious carnivore. The aard wolf, or "earth" wolf as the phrase is to be translated, is a nocturnal creature that lives in deserted or unappropriated dwellings of the aard vark or earth pig, the "Edentate" *Orycteropus*. The Swede Sparrman, who first gave a proper account of this feeble relation of the hyænas, called it "viverra," and as a matter of fact, it has rather more affinities to the Viverridæ, or civet tribe, than have the hyænas, though the latter come nearer to that group of cat-like animals, than to the cats proper. The ineffective teeth of the hyæna-like *Proteles* are readily explained when its food is taken into account. The stomachs of no less than fifty individuals have been examined (it is hoped that the creature is now on the "protected list"), and in all of them nothing but termites (white "ants") were found. At the Zoo, a mixture of finely chopped meat and milk and bread does duty, or rather did duty, in the case of this animal and the ant-eaters, for the real article of diet. It would seem, however, that *Proteles* has copied the objectionable habit of the chacma baboon (see page 32), and has taken to killing lambs for the sake of the curdled

milk in their stomachs. So that what with this habit and the zeal for science exhibited in returning the compliment by examining its stomach, the days of *Proteles* will probably not be long in the land. Like most carnivora *Proteles* has glands secreting a strongly flavoured liquid at the root of the tail. In the case of the skunk, these glands, well-known in that animal, are doubtless for aggressive purposes. Most probably, as it appears to us, the variety of flavours which these glands produce in different animals are "recognition odours," a more effective way, one would think, for individuals of a species to recognize each other than the white patches, and other recognition marks, seeing that in mammals generally the sense of smell is superior to that of sight.

Cape Hunting Dog

Dogs are usually gregarious animals as everyone knows, and the hunting of wolves in packs occurred as an incident, or used to occur, in every juvenile book of adventure, rightly impressing upon the mind this fact in Natural History. The *Lycaon pictus* shows its dog-like characters by the fact of its similar mode of hunting, and not only by its anatomical structure. As to the latter, it is important to note some of the features which distinguish the dogs which form a distinct group of the carnivora, from the cat-like and bear-like carnivores. As to colour, dogs do not, as a rule, produce spots or stripes while cats do very generally, and the members of the bear tribe frequently have ringed tails. It is true that there are spotted dogs ; but these where not signs of conviviality are artificial breeds. Dogs are digitigrade like the cats, but they have not retractile claws, and they do not use their comparatively blunt claws for tearing and scratching like the cat. Unlike the "cat i' the adage," they do not dislike water. Cats are

solitary; dogs as already mentioned, are friendly to each other and gregarious. Indeed, the fondness of the dog for man is held to be a mistake on the part of the dog who considers his master to be a superior kind of dog, ready for country excursions and the pursuit of game. Bears, it will be remembered, are plantigrade, i.e. they walk upon the palms of the hands, and the sole of the feet. They may have a prehensile tail, which a dog never has. Their intestine is not furnished with a blind appendage, the cæcum. The intestines of both cat and dogs are so provided. There are points in the skull and the teeth which differentiate the three groups which the late President of the Zoological Society, Sir William Flower, called respectively, Aeluroidea, Cynoidea, and Arctoidea. *Lycaon* hunts in packs, whence its vernacular name. These associations consist of some fifteen on an average; but as few as four, and as many as sixty have been noted in one pack. They pursue their prey with skill and unanimity: so quick are they in their movements that the quarry is sighted (or smelt), caught, and eaten before the indignant farmer or sportsman can come come up with the depredators. The colour of this dog is one of the most remarkable features. The ground colour is a buffish yellow marked with irregular blotches of dark brown. It has so distinct a likeness to an hyæna, that the naturalist who first described and named this dog, actually placed it with the hyænas. It has only four toes instead of the usual canine five. Its voice is various; it barks, chatters like a monkey, and says "ho, ho," like "the second note of a cuckoo."

Blue and White Foxes

The blue fox of commerce and of the Arctic regions is the summer form of the white fox of the same quarter of the globe. But it appears that this change of fur on the approach of winter is by no means universal; and some

have even gone so far as to assert that the change is rare or never occurs, and that in consequence the two forms *are* two forms, and not merely seasonal varieties. There is no doubt, however, that the change does take place ; for foxes at the Zoo have been known to put off one coat and take on the other. In Spitzbergen, and in all such very northerly latitudes, the change takes place ; but in Iceland, the southernmost land inhabited by this fox, there is no change in winter, a case which is paralleled by the polar hare of this country, which changes to white in winter in Scotland, but not in the damper, and thus warmer, Ireland. Though now limited to the frozen north, this fox in former days wandered farther south, as its fossil remains in this country show. The same is true of many animals now definitely confined to polar latitudes, such as the polar bear and the reindeer. This fox feeds upon ptarmigan or any birds that it can get, and upon cast up carcasses of seals and whales ; it is also fond of shell-fish and of eggs. In the winter of the north it is difficult for it to get any food at all, and it has been suggested that it stores up food when there is a surplus for a rainy or, better perhaps, a snowy day. But the exact observation wanting to confirm such a story appears to be lacking so far. It is described as uttering a " yapping bark." It is called a fox mainly because of its small size and long tail. The dogs, wolves, jackals and foxes, form in reality a highly uniform assemblage of carnivores. By certain small skull characters it is possible to separate a fox-like series from a wolf-like series. Viewed in this way, Azara's fox of South America is a wolf and a jackal is a wolf ; but the Reynard of England, as well as its arctic ally, is a fox. To those who have not had the opportunity of examining the bones the jackals suggest a fox rather than a dog or wolf. But probably no one would doubt the fox-like nature of *Canis lagopus*, the arctic fox.

CHAPTER V

The Polar Bear.

THE bear tribe in the strict sense, that is the family Ursidæ, differ from the other bear-like creatures, which we have considered, by their larger size and massive build. Even the little and very spry Malay bear is big when compared with e.g. a glutton, one of the largest of the non-ursine Arctoidea. Although bears can dig, they cannot, or at any rate do not, burrow holes for themselves like others of their allies, such as the badger. The polar bear differs from its congeners mainly in its very large size and white fur. The Zoological Society have exhibited in the past fairly large polar bears, and it will have been noticed by those who saw some of those animals that the fur was not of that brilliant whiteness with which it is wont to be represented in works upon Natural history. To set down this loss of pure colour to the "smuts" prevalent even in Regent's Park would be incorrect; for the polar bear is really only pure white when young. It gets brown with age, and the sailors who know it in its haunts call it "Brownie." Darkening with age is a common phenomenon in animals, and is even noticeable in ourselves before, of course, the ultimate whitening of senility.

This bear has been also nicknamed the "farmer" owing to its leisurely and agricultural gait. The polar bear, "alone and palely loitering," in very

POLAR BEAR

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truth, for as a rule the males and females go about in solitary walks, is one of those animals which go right round the pole. It is found in Greenland and Spitzbergen and other places within the arctic circle ; in past times it extended its range farther south probably when the climatic conditions were more severe over northern Europe than they are at present ; for its remains have been found in the neighbourhood of Hamburg. The underside of the feet of this bear are partly covered with fur and not naked and horny merely as in other bears. It seems clear that this furriness can be put down to a need for progressing with safety upon slippery ice. It eats seals and dead whales, but especially seals. It has been known also to clear off a series of eider duck's eggs. This bear does not seem to be particularly fierce unless provoked. The general impression of ferocity which a large carnivore inspires has no doubt led to some exaggeration of its aggressiveness. At the Zoo, polar bears are as a rule noteworthy for their affability to the general public. One of the triumphs of longevity at the Zoo was a bear of this species, who lived in those gardens, for no less than thirty-seven years. The polar bear does not give that hug for which bears are so notorious ; it contents itself with biting.

The Glutton

The glutton or wolverene is as handsome a beast as is any of the fur-bearing animals of the north. It is circumpolar, as are so many creatures of the north, and though now not found in Europe at a lower range than Norway, it was German a few centuries ago. More centuries ago still, in fact thousands of years since, the glutton dwelt in this island, as its remains in Norfolk show us. In spite of its regrettable habits, upon which we propose to enlarge immediately, the glutton is a

handsome beast. It has rich glossy brown fur and is of respectable size, and quite one of the largest of the Musteline carnivores which are closely related to the bears but still more nearly to the lithe stoats, and the aquatic otter.

It walks about on the soles of the feet in the true bear fashion, and this walk is in captivity agitated and rapid as is the way with many captive carnivora, especially the little ratel *Mellivora*, its near neighbour at the Zoo, though not in Nature, as it is African and Indian. The latter complicates its rapid walk to and fro by an occasional somersault. The glutton has a short tail, which is largely hidden by the thick fur, a truly bear-like attribute. Like the polar bear, and perhaps for similar reasons, our wolverene has hairy palms and soles. Like other carnivora, especially of course the American "essence pedlar" or skunk, the glutton is provided with glands which secrete an abominably smelling fluid, which can be shot to a distance, and is probably a better safeguard than its teeth and claws, against invasion of its rights. For though stories are current of a highly spiced nature, it seems that the ferocity of the glutton is much exaggerated. Not so, however, its voracity, and its very name both in English and in Latin (*Gulo*) is a testimony to accurate public opinion. In his *Historia de Gentibus Septentrionalibus* Olaus Magnus, Archbishop of Upsala, in the fourteen hundreds, spoke concerning the glutton with no uncertain note. "This animal," observed the archbishop (in Latin), "is most voracious. When a body is discovered it eats with such rapidity that its belly becomes distended like a drum." Later on a freeish translation is perhaps more advisable. The Latin may be thus rendered: "The creature seeks some conveniently close tree trunks between which it squeezes itself like an orange and is then ready to commence anew. This

alternate procedure lasts as long as does the carcass; after it is eaten up to the last morsel, the glutton sets out in quest of another." It suggests, as occurs to Olaus Magnus, the ancient Romans who, "vorando bibendoque vomunt redeuntque ad mensam." Like many eaters of carcasses the glutton also pursues and kills living food.

It is said to bring great cunning to bear upon its predatory expeditions and to observe, and select in accordance with its observations, a tree whose bark has been scored by the horns of the expected deer, and then to spring with one fierce bound upon its neck and crunch it to death. In any case it has been indisputably seen running hard after a hare. It is much more likely that the glutton is mainly devoted to carrion, but that now and then, by way of a variety, it succeeds in overpowering some weakly but living creature. This "vulture among quadrupeds," as it has not ineptly been called, is nevertheless tamable. Audubon and Bachman, who are among the principal natural historians of the animals of North America, relate that a *Gulo* was so adequately tamed that it sat up on its haunches and smoked a pipe. It is an odd fact, exemplified also in the chimpanzee "Consul," that the imitation of smoking is always gloried over and "par'd" as a human attribute much more than such genuine human qualities as the capacity for counting and other really intellectual achievements on the part of monkeys and others. It is true that the "learned pig" appears to confute this suggestion. But it is gravely to be suspected that that favourite of some decades since also held a pipe and referred to a tall glass. The late Dr. Elliot Coues, the American ornithologist, was struck by the magpie-like curiosity of the glutton, a characteristic which it shares with the raccoon, its ally. An individual stole from a

camp, blankets, knives, and indeed all removable paraphernalia. The glutton when dead is much better than a living dog. Its skin is of course immensely valuable. In mediæval medicine the glutton, like the beaver, the toad, and the woodlice, in fact the animal creation generally, figured in prescriptions. The blood when diluted with hot water is recommended to the hunter who desires success, mingled with honey it is a *sine quâ non* for the lover who would gain his ends.

The Raccoon

The French anatomist de Blainville aptly called this small carnivore "Subursus," a name which exactly expresses its relationship to other carnivora. For it belongs to the bear tribe in a wide sense, though presenting us with many points of difference to the true bears. Its general aspect is not unbear-like; but the long ringed tail is a character which no real bear in the restricted sense possesses. Like the bears, too, the raccoon walks flatfootedly; it is plantigrade instead of walking on the toes, as do the cats and dogs. Its limbs, moreover, are very long for an animal of this group, which gives to it when walking a curious bunched up appearance. The word "coon," as most persons know, is but a corruption of raccoon, and raccoon itself, as fewer persons know, is again a corruption from the Indian name for this animal, viz. Arathcon. It is a purely American beast, and the "washing" raccoon as it has been termed, *Procyon lotor*, is an inhabitant of North America. The crab-eating raccoon, *P. cancrivorus*, is from the South. A number of other names have been given; for instance one form has been called, after the historian of South American natural history, *Procyon Hernandezi*. Our English Pennant, the correspondent of Gilbert White, and historian of London as well of as beasts, wrote of the 'coon that it is "very good-

RACCOON

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natured and sportive, but as unlucky as a monkey." He furthermore described it as very inquisitive, and alleges that it will, if the opportunity arise, " like Roger the monk, get excessively drunk." The American Aubudon, with his colleague Bachman, called it " cunnning, easily tamed, and makes a pleasant monkey-like pet." It is indeed a very Paul Pry among non-human mammals. This renders it not so desirable as a pet; for it will uncork bottles, open doors, and generally put its nose and fingers where they should not be. In a state of nature the Procyon is " sly, dey-vilish sly." The beast watches, we are told, the turtle when about to deposit her eggs, and " sometimes by the margin of a pond or crouched among tall reeds and grasses, grimalkin-like, the raccoon lies still as death waiting with patience for some ill-fated duck that may come within its reach." All or nearly all is fish that comes to the raccoon's net. Poultry, mice, eggs, insects and fruit form the staple of its diet; and it will turn over stones in its search for crayfish. The southern species is so called on this very account. " The habits of the muscles (*sic*) that inhabit our freshwater rivers are better known to the raccoon than to most conchologists," wrote Audubon and Bachman. And there are legends to the effect that in its quest of oysters, the raccoon sometimes gets a paw shut in the shell of the angry mollusc, and thus fast trapped is drowned by the rising tide. This, however, is a tale which has been naturally viewed with suspicion. It is clear, notwithstanding, that the raccoon is very universal in its choice of food, a circumstance which is always to the advantage of an animal with so wide a taste. Omnivorousness is also writ large upon its teeth, the molars being wide crowned and tubercular, not thin and with cutting edges as in the purely carnivorous cat tribe. It seems to be generally believed that the raccoon handles and washes its food

before eating it ; we certainly have noticed something of the kind among the numerous specimens that have been exhibited at the Zoological Gardens. Yet Audubon, who knew his beasts and especially his birds well, distinctly says that he never saw anything of the kind. Living as it does in a climate which varies greatly from summer to winter it is natural that the raccoon should hibernate. But apparently this habit is not universal in the race. For they have been seen at large in the winter, braving the extreme cold of North America. This being the case it is not surprising to learn that the hibernation is a very perfunctory affair as compared with the preparations indulged in by some other mammals. The 'coon makes for itself no special home for the winter, but lies coiled up in the hollow trunk of a tree, or even upon the branches of the same. It is in fact mostly an arboreal creature, though it can swim and capture fish. It makes its home in trees and carries on its business elsewhere. This is one of the animals concerning which it can safely be said that there is sure to be at least a single specimen on view at the Zoo, and probably of both the " common " and the " crab-eating " species.

The Patagonian and other Sea Lions

The Patagonian sea lion, *Otaria jubata*, is, as its name suggests, a native of the sea coasts of the extreme south of the American continent, and of certain adjacent groups of islands. The term sea " lion, " and the scientific name of the species " jubata," mark a distinctive character of this species, which is the possession of a name not visible in the animal unless its fur has got dry through basking in the sun. To the several other species of " otaries " (for example the Cape otary which is figured herewith), the name sea bear is given, a name which has distinct merits in that it is perhaps to the bear tribe among the fissipede carnivora that the Pinni-

CAPE SEA LION

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pedia are most nearly allied. An alternative name to otary as applied to the whole group is eared seal; both these names embody a fact which is of considerable importance for the discrimination of these aquatic carnivora from seals and walruses. They possess indeed a tiny external ear, the conch as it is called, which is completely absent in the seals. The seals and walruses have to get along with a mere hole in the side of the head, and are in the position of a seventeenth century political or religious offender, who has had his ears cropped. The persistence of this external ear is one of several features in which the otaries have retained more of the characteristics of a land-living ancestor than have the seals. Other points which can be readily seen in the living examples at the Zoo are the following. The fore and hind flippers are not merely flippers as they are in the seal; indeed in the latter animal, the hind flippers are, as it were, soldered to the tail, and form with it a single steering apparatus. In the sea lions and sea bears the flippers have still got some independent movement and their possessors can shuffle along on the land in a successful if awkward fashion, while the seal can merely wriggle along as would a man whose legs and arms had been tied to his body. More than this, the nostrils are at the end of the snout in otaries, and on the upper surface in seals, a position which is more convenient in an aquatic animal whose aim in life it is to respire at the surface of the water with as little as possible of the body showing. These various features lead us to the not unnatural inference that the true seals have been for a longer period adapted to a purely aquatic existence than have the sea lions. The more obvious neck contrasting with the " bull neck " of seals is a fact to be urged as pointing in the same direction, while the claws on the hands and feet, though also to be regarded as survivals, are to be met with in the seals,

and thus do not place the two families relatively.

There are several kinds of sea lions and sea bears, probably at least eight, though the exact numbers are still a matter of uncertainty. From a well known and northern kind, *Otaria ursina*, is obtained the sealskin of commerce. The paradox is therefore true that sealskin is not the skin of a seal. These fur-bearing sea bears are often spoken of as fur seals in contra-distinction to those which have no fine under fur, but only coarse hair, and which are therefore called hair seals. But no anatomical characters, other than this, allow us to distinguish two groups in the family. Although this sea lion, and hair seals in general, do not furnish coats and waistcoasts for the rich and cold, there are other hair seals who are by no means on this count free from alarms. Thus Steller's sea bear almost takes the place among the natives of the Aleutian islands that the reindeer does with the Laps. The flesh, fishy, and unappetising as it might well be to ourselves, is eaten, and of course, is said to resemble veal, as all strange meats are. Its abundant fat is the local substitute for coal and gas. For the storing of this fuel the animal's stomach forms a convenient receptacle. The skin is used to cover boats. The gullet becomes the boots of the huntsman or occupant of the boat, and the intestines sewn together afford him a nondescript and waterproof garment. Nothing in short is wasted by him except the skeleton, and even this is sought after by others, for museums. Sea lions congregate together in herds upon rocks, which temporary dwelling places are termed "rookeries," though "Why rookeries?" we may well exclaim with Miss Betsy Trotwood. This friendliness, tempered, however, in the wild state by acts of discipline on the part of the large males, does not extend to individuals of different species; and in the large pond at the Zoo, if there is more than one sea lion an arrangement of

the nature meted out to Box and Cox is adopted. While one beast sports in the water the other gazes enviously from the interior of a shed, and separated by a gate; otherwise misunderstandings might arise. Sea lions are fish eaters in a wide and non-zoological sense; for they are partial to crustaceans as well. An ingenious "dodge," was adopted at the Zoo by the late Mr. A. D. Bartlett some years since to tempt the appetite of a sickly sea bear, which had been left for its health's sake by a travelling menagerie. The otary was turned into the pond in company with some live eels; and the pleasures of the chase induced it to make a hearty meal. The intelligence of a sea lion is on a fairly high level, and most persons have seen its dexterous catching of morsels of fish and its obedience to the commands of its keeper; there will be some too, who remember Leconte, the old Frenchman who long presided over the sea lions at the Zoo.

The Gnawing Mammals, order Rodentia

There is no difficulty whatever in recognizing a rodent, and in distinguishing it from any other group of existing mammals. There are only two living creatures which might cause confusion, and they are the Magadascar lemur, *Chiromys*, and the ungulate, *Hyrax*. But we have seen that there is no need to perplex ourselves over their correct placing. In all rodents the canine teeth are entirely absent, and in all of them there are but one pair of efficient incisor teeth in each jaw which are long and chisel-shaped and allow the rodent to perform its typical function, that of gnawing. It is true, that in the hares and rabbits there is a minute supplementary pair in the upper jaw; but these are so small that they do not impair the general rodent-like aspect of the animal.

There is an extraordinary variety of rodents, scattered practically over the whole surface of the world. They

are more abundant in generic and specific types than any other existing order of mammals ; and the reason for their abundance and variation may perhaps be sought for in their small size and retiring ways. They skulk, burrow, hide in holes, secrete themselves in leafy retreats, dive under the water, and generally shun observation. Besides the few forms of rodents which will be noticed in the following pages, a good many forms are usually on view in the Zoological Gardens. There are, for instance, commonly to be seen beavers, once, and that within the historic period, a denizen of the British Islands ; squirrels of many kinds, besides the so-called " flying " squirrels with a parachute stretching from arm to leg ; the marmot of the Alps, and that of India ; many rats of diverse kinds ; the South American agouti, and its ally the guinea pig (really Guiana pig); the hopping jerboa of the East, so like a small kangaroo, and related Cape jumping hare (*Pedetes cafer*) ; the little sandy coloured gerbilles and other rat-like creatures.

The Vizcacha

South America, which fosters the muff-producing chinchilla, also is inhabited by the vizcacha or *Lagostomus trichodactylus*, a smallish rodent of the same family, Chinchillidæ. The tail is long and the colour is dark, agreeably diversified by white patches on the cheeks and below. Unlike the chinchilla, the vizcacha dwells on the Pampas, and constructs there burrows in the soil, which are associated in number to form veritable cities, the so-called " vizcacheras." Like many of the cursorial rodents, the *Lagostomus* has its toes reduced to four on each front limb, and three on each hind limb. The underground cities which the vizcachas build and inhabit, consist of many burrows which intercommunicate, so that if an enemy enters by one door the vizcacha can bolt by another, like a pickpocket through

those convenient houses modified for his benefit. Like the burrowing marmot of North America miscalled the prairie *dog*, the vizcacha harbours, apparently not unwillingly, a varied assortment of lodgers. They belong to many classes of the animal kingdom. A fox is the largest of these boarders, and though he and his vixen devour the young vizcachas, it is apparently regarded merely as "churchyard luck" by the parents, who exhibit no particular symptoms of animosity against vulpes. A weasel also lives almost entirely with the vizcachas, and in his sheer innocence of intent it is hard to believe. Quite harmless are two species of swallow which build their nests upon the sides of the burrows like sand martins at home. Various wasps and beetles complete the list. In North America the rattlesnake and the burrowing owl live with the prairie dog in harmony. In South America the same owl visits the vizcacheras occasionally, and sits outside. This seems to be pure sociability on the owl's part, for the bird does not apparently make any use of its acquaintance. The chief foes of the vizcachas are the jaguar and the puma; the domestic dog they do not care about, but baffle his frantic attempts to catch them, by coolly, but with an exact appreciation of the moments necessary for the action, dive into their burrow just before his jaws close upon them. Mr. Hudson, who is the chief authority upon the habits of this sociable little rodent, doubts if there is "any other four-footed beast so loquacious or with a dialect so extensive" as is the vizcacha. Being a white-fleshed rodent who does not lead too active a life the meat of the vizcacha is good to eat.

Porcupines

Such terms as "the sharp quilled porpentyne" and the "werely porpapyne," though bewildering in their

spelling, and tending to the concealment of the origin of its name, illustrate the principal external feature of this large rodent. You cannot, however, tell the "warlike porcupine" by its quills; for such thick, solid and sharp hairs, they are nothing else, are common, not only among rodents, but in the insectivora, and even in the spiny anteater of Australia, which is a representative of the most ancient type of mammal known. How then is a porcupine to be distinguished from an overgrown rat, a magnified representative of the spiny mice? For one thing, it has spines on its tail, which the spiny mice have not. But to be absolutely certain, recourse must be had to bony and other internal characters. The porcupines are also larger than any other spiny rodent, and there is of course no possibility of confusing them with sharp-nosed and sharp-toothed hedgehog, or *Centetes*. The tail will betray the mouse—

> Show him a mouse's tail and he will guess
> With metaphysic swiftness at the mouse

and at the Porcupine. The spines have of course given its name to the Porcupine. But it is not certain whether the derivation from "Porc Epic," i.e. pig-spine, is correct, or the more probable "Porte Epic," i.e. spine bearer. As to the pig alternative, the fondness for calling beasts pigs with a qualification, is universal. The porpoise is the pig fish; the "Porcus marinus" of the ancients was a beast of some kind, but one does not know what. The only claim which the porcupine puts forth to this derivation is that, according to the Indian naturalist, Jerdon, the flesh of the porcupine resembles roast pig, with a dash of veal, however, a flavour that seems, according to travellers and gastronomic experimenters, to be the flavour of almost everything new to the palate. The spines enter largely into the genuine natural history of the porcupine, as well as into legend. They are plainly

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a protective armature, and it will be noticed at the Zoo that, if a porcupine is alarmed or threatened, it instinctively bristles out its spines and turns its back upon the quarter whence threatens the supposed aggression. Yet it is clear that these fixed bayonets are not inexpugnable. For we are told that the tiger will make a meal of a porcupine. As to legend, there is of course the story that the porcupine shoots its quills. This legend is utilised in the coat of arms of the French king, Louis XII., who bore armorially a porcupine with the motto " Comminus et eminus," i.e. prepared for enemies close at hand and at a distance. There is a pig-like suggestion too in the legend that the porcupine is especially infuriated by, and will savagely attack, venomous serpents ; for it is well known that a pig will encounter, trample to death, and munch up the fierce Fer de Lance of the West Indies. The porcupine is alleged to roll upon the snake and transfix it with its spines, just as the purely insect-eating hedgehog of this country is alleged to roll over fallen apples in the orchard and bear them off to its lair. If the common porcupine of Asia, Africa, and even of certain parts of Southern Europe, be watched, the origin of the legend concerning the shooting off of its spines will be clear to the onlooker. It has the habit when annoyed of rustling its spines, and in the effort of rustling some of the spines will fall to the ground, or even be shaken to a little distance away. To such a small cause is the archery of the porcupine reduced. It is a remarkable fact that the porcupines of north and South America are arboreal, and that those of South America, which have a long tail, have that tail prehensile. There is thus an exact parallel between the monkey of the two hemispheres and the porcupines of the Old and New Worlds. Of the Canadian Urson and of the South American tree porcupines (*Synetheres* or *Coendou*), at any rate, of the latter, there are often, if

not usually, specimens at the Zoo. It is a curious fact that a peculiar long-tailed porcupine of the Old World has such a habit of ridding itself of that tail by misadventure, that the original specimen was ineptly called *Trichys lipura*.

The Lemming

There are several kinds of lemmings, at fewest two, which are circumpolar in range, and are found in the extreme of North America and Greenland, in Siberia and the north of Europe. They are little rodents, especially closely allied to the real water-rat, or vole, and belonging like that rodent, to a great family Muridæ, which embraces anything and everything that can be really termed a rat. The most familiar kind of lemming is the little animal which lives in the central highlands of Norway, and whose migrations are referred to in every book on popular zoology. It has been an inmate of the Zoo, though at the moment of writing there are no examples of it. So associated is this little beast with its restless and persevering habits, that but a trifle is known about it when really at home in central Norway. The migrations seem to be associated with hunger ; unusual fertility produced lemmings in excess of available food. It is exactly the same thing that occasionally occurs with other rodents, more particularly with the field vole, of which there were phenomenal swarms in Scotland a few years back. When this event occurs, which is at quite irregular intervals, the lemmings put their best foot forward and set forth on their journey. So suddenly, and in such hordes, do they appear, that in old days they were held to be rained from the skies, as many persons believe with regard to frogs at the present day. They cross streams, descend and ascend cliffs, on their journeyings, and in fact are impeded by no obstacle surmount-

able or apparently insurmountable. This perseverance, however, leads to nothing; for from these exodus no lemming ever returns. Like the Crusaders of old, they die from various causes on their travels. From falling into water, from fights with one another, and a vast quantity of them fall a prey to wolves and gluttons, buzzards and ravens, who haunt their route and take abundant toll of the migrants. Occasionally during a lemming year a fever arises along the route among the human inhabitants, which is called lemming fever. This is due to the numerous putrefying corpses left along the way, and is a testimony to their multitudes. The rapidity with which lemmings multiply is well put by Dr. Brehm, who says, "All the young of the first litter of the various lemming females thrive, and six weeks later at the most these also multiply. Meanwhile the parents have brought forth a second and a third litter, and these in their turn bring forth young." In past times lemmings lived in this country, and the interesting observation has been lately made of quite fresh-looking skeletons, with skins attached, in Portugal. It seems possible that lemmings still lurk among the fastnesses of the Iberian peninsula.

The Capybara

Apart from the mysterious, and until this year almost fabulous Dinomys, of which the first and only example known until lately was met with casually wandering round the courtyard of a house in a remote Peruvian town, without visible means of subsistence or ascertainable residence, the capybara, or carpincho, is the largest existing rodent. There was once upon a time—literally "when pigs were swine," for the Suiæ were of a generalized type, and could be better called swine than pig, which denotes the Chinese domestic variety—a rodent

obviously termed *Megamys*, with a body as big as an ox. The capybara is contented with the bulk of a sheep. It is a rodent whose nearest living allies are the Patagonian cavy, which looks like a weird long-legged hare, and of which there are always examples in the Gardens, and of the restless cavy, better known, when domesticated, as the Guinea pig. It might be thought that the name of the latter forbade any close alliance with the American carpincho. But Guinea in this case is merely a corruption of Guiana. All the members of this family of rodents are in fact limited to the southern half of the American continent. The capybara, whose scientific name is *Hydrochoerus capybara*, which of course—the generic name that is—signifies water hog, is much addicted to water, and has distinct points of likeness to the ungulates generally, if not to the pigs in particular. The skin is thick, and rather sparsely haired, with coarse hairs as compared to such a rodent as the squirrel, or even its ally, the Guiana pig. The toes are reduced in number, which is, as we have seen, an ungulate character ; their nails are approaching towards hoofs in character ; and finally the last molar tooth is of great length, as in the wart hog and, indeed, the elephant. Being largely aquatic it is not surprising to find that the hind toes are to some extent webbed. These creatures are sociable and frequent banks of rivers, whence they constantly plunge into the water, in which element they are adept swimmers. They delight in wallowing in mud like other thick-skinned beasts. Their gait is a clumsy gallop, and is compared by Mr. Aplin with that of the Guiana pig. The step of the carpincho in fact betrays the cavian. The blundering way in which these heavy rodents charge when disturbed is a source of terror to horses, who will not face them. They are literally thick skinned ; but in recompense they have the most complicated and furrowed brain of all rodents.

ALLIES OF THE HEDGEHOG

Order Insectivora

Some of the characters of this archaic group have been already referred to under the carnivora. Others will be found below.

CENTETES.

Madagascar is a kind of common lodging-house for weird and ancient beasts who have found sanctuary in its impenetrable forests, unfrequented by many carnivorous animals, and have thus escaped the extinction which their relatives have suffered elsewhere. Thus it is in Madagascar that the vast majority of the lemurs, those archaic forerunners of the monkey tribe, are to be found. The more modern types, such as the monkeys themselves, and the bears and antelopes and feline carnivora, have never, as it appears, even gained access to Madagascar, which was cut off, it is believed, from the African continent some ages since. Among the peculiar beasts of that great island is the hedgehog-like *Centetes*, which belongs to the insectivora, a group which represents, as it would seem, an archaic state of affairs. Like the rodents, the insectivores have habituated themselves to almost every kind of life ; they burrow like the moles, swim like certain shrews, and the West African " otter " *Potamogale*, even fly, when we remember that the Colugo, *Galeopithecus*, is at leastn ot very remote from this group ; they especially favour a lurking existence, slinking in the underwood, and dwelling in holes ; in fact they do everything except lead an open and ravening life. It is perhaps for these reasons, coupled with their small size, that the insectivora, as a group, have persisted, and are indeed so numerous in their varied kinds. *Centetes* is not by any means unlike a hedgehog in general aspect. It is a small brownish creature with a long snout, and with hairs which are stiff and yet are called hairs. A different name will be given by any one

who handles the *Centetes* incautiously. It is really not far inferior to the hedgehog in spininess. In young stages it has definite bands of long spines down the body. Spines of course are a common feature of the whole race of insectivorous animals. They have, too, sharp teeth and well-developed canines. The bite of *Centetes* is a serious matter. It feeds upon earthworms chiefly. The Tendrec, Tanrec or Tenrec, as its various native aliases run, is one of the most prolific of mammals. It is said to produce twenty-one young at a birth. It has no tail and a very small brain, so small, indeed, that it is no larger in comparison to the skull than the extremely minute brains of certain extinct animals of the dim past belonging to quite other groups, and whose disappearance is perhaps partly to be explained by their lack of cunning. Measured by this standard the Tenrec is not long for this world. Few insectivores are to be seen at the Zoo. They do not readily lend themselves to captivity. It is clear that moles and shrews are not suitable exhibits. The Tupaia, however, a Malayan insectivora that seems to mimic a squirrel, is one of the few types that has been at the Zoo.

Order Edentata

This is a heterogeneous assemblage of peculiarly weird-looking beasts of doubtful relations to other mammals, and indeed to each other. Though it is plain enough from anatomical considerations, and from the analysis of extinct forms, that the sloth, American anteaters, and armadillos, form a closely related assemblage, it is not at all plain that these have any relation whatever to the Manis and the Orycteropus of the Old World, or that the two latter are in any way related to each other. Why then, it may fairly be asked, are all those creatures placed in one order, Edentata. The reasons in truth are of a negative character, and are simply an expression of the

present powerlessness of zoologists to do any better. They fit in nowhere else, and in the meantime the group Edentata may be retained as an assemblage of creatures which admittedly require sorting out when we are able to do it.

The American Ant-eater

One of the most remarkable types of animal life which frequent the gloomy forests of South America is the great ant-bear, *Myrmecophaga jubata*, the maned ant-eater as it might be better called, in deference to its Linnæan name. Claws, tail and tongue, are its most striking attributes, and are most intimately concerned with its mode of life. It is a large and not uncomely beast, of a greyish black colour, with a conspicuous stripe over the shoulder, a small head at the end of a longish neck, and with a great bushy tail, which is carried in an arched fashion. Including this tail the ant-bear gets to be as long as seven feet, and the two sexes are of the same build and colour. The claws are so long and stout that the beast has to walk upon the sides of them. Their massive character is in association with the fact that the animal tears open the high ant-hills inhabited by the termites, or white ants of South America, which are often constructed with great solidity. The emerging ants are then licked up by the extraordinarily long and thin tongue, aided by a copious secretion of saliva. In most mammals the salivary glands are limited to the head and throat. But in *Myrmecophaga* these glands extend right over the breast, and are thus in a position to produce an enormous quantity of the necessary bird-lime for the capture of its prey. Like *Manis* of the East, *Myrmecophaga* has a mouth as toothless as that of the crone. But what it lacks in offensiveness in the mouth it makes up for by its claws, which can rip open any dog in a stroke or two. Their more effective use as an instru-

ment and as a weapon is arrived at by the exaggeration of one of them, the middle claw ; this has grown at the expense of the rest, and has thus been able with the same available material to reach a larger size and strength than if the material were distributed fairly through the hand. It will be just as well not to investigate in the Zoo the nature and uses of these claws. An individual possessed by the idea that the umbrella of commerce was an implement of use in the study of zoological problems, proceeded to roke out an ant-bear. The ant-bear retaliated, and the result was that there was no evidence on the umbrella, but only in the paws of the bear, that it had ever had a silk cover. The long and bushy tail has a use that was at first scouted as improbable, but is now upheld. During sleep and in stormy weather, *Myrmecophaga* winds its tail round its head and body in such a way that they must be protected from the weather. This ant-bear is never arboreal. But South America nourishes two allied genera, viz. *Tamandua* and *Cyclothurus*, which both live in trees. The former is not unfrequently to be seen at the Zoo.

The Sloth

An exceedingly dependent animal is the sloth. It lives in a continual state of suspense, as Sidney Smith remarked, like a curate distantly related to a bishop. The same reverend and witty author furthermore added that the uses of a sloth hanging from the branches of a Brazilian forest were not obvious ; but that on the other hand it might be fairly asked, " What was the use of a gentleman in Bond Street ? " We need not now ask such a question concerning the sloth ; there are other and more pressing queries. There is no better instance in the whole animal kingdom of a creature which is

exactly suited to its mode of life. Cut down forests and sloths must inevitably disappear. It is as purely arboreal as the whale is aquatic. But while many partly or wholly arboreal beasts (for example, the tree kangaroo, described later) are much like their immediate relatives which live upon the ground, the sloth is so constructed that it differs absolutely from its nearest allies ; its closely approximated and bent claws can only serve as hooks for suspension. Nevertheless, the sloth can progress upon the ground, but only with difficulty and pain. Waterton relates in his *Wanderings*, that he kept a tame sloth ; but, indeed, the term tame as applied to perhaps the most peaceful even among vegetarian creatures, seems unnecessary. And upon this sloth he made observations as to its walking powers. The melancholy, and at the same time slightly comic, aspect of the sloth, incited M. de Buffon to the following singular series of remarks in his natural history. The life of the sloth being restricted, and its general circumstance untoward, the visage of the animal has retained their impress ; for " all these circumstances announce their wretchedness and call to our mind those imperfect sketches of Nature, which, having scarcely the power of existence, only remained a short time in the world, and were then effaced from the list of beings." It was further the great French naturalist's opinion that some animals, like some men, seem to be created only for sadness. De Buffon had to write with a vigilant and aggressive clergy in his mind and was compelled to adopt these somewhat hypocritical sentiments. But in spite of this, which was at the time the orthodox view of the animal creation, the sloth is by no means an animal to be pitied. No creature that is perfectly in accord and harmony with surrounding nature, inanimate as well as animate, can be distressful. The visitor to the Zoo will note at once two distinct features about the sloth ; firstly, its close and shaggy

covering of long and coarse hair; secondly, the immensely long and hooked claws, which are two in the fore limbs in the case of the two-toed sloth, *Cholœpus*, and three in *Bradypus*.

It has no fingers to crook to retain its hold upon a branch; nature has already hooked them for it in a permanent fashion. It can only clutch. The long, wiry hair droops over its body, and forms an excellent shelter against a tropical downpour. As to this hair, it has been pointed out that it fadges well with the sloth's habits. Instead of lying in different directions in different regions of the body, as is so generally the case with the mammalia, the hair "flows" only downwards; it cannot therefore get wet. But a third danger remains besides the chance of falling, and of getting a soaking. The sloth has tender flesh, and is an appetizing morsel to tree-frequenting beasts of prey; and South America harbours one of the largest of these, to wit, the jaguar. Defenceless as the sloth is against such attacks, nature has provided it with the means of apparently circumventing probable foes. It will very possibly be noticed in examining carefully the hair of the sloth, that this has often a distinctly green colour. Now it was ascertained a good many years ago that this green colour was not in the least due to an actual green colour of the individual hairs, but to the presence within them of minute green plants similar to those which colour so vividly the weather side of trees, to microscopic algæ in fact. This gives to the pelage of our sloth a not unstriking likeness to lichens, which is borne out by its bunched-up body, not unlike a tree stump. There is, in fact, in one sloth at least—there are several species of sloth—a mark in the middle of the back which suggests a broken end of a branch. Thus we see that the wind is tempered to the shorn lamb, if, indeed, so very shaggy a creature may be used as an illustration of this dictum.

The Armadillo

The "little knight in armour" of South America, and of that continent only, is perhaps about as unlike the "dreaming sloth of pallid hue" of the same continent as any two beasts can well be, that are admittedly both mammals. And yet, while some of the other types —the *Manis* and the *Orycteropus*—which are by some placed in the same order, that of Edentates, are really unlike the armadillo, there are numerous facts in the structure of the sloth which show it to be akin. In no other part of the world than in America are there, or have there been ever, so far as our knowledge enables us to state, animals belonging to these three types, the sloths, armadillos and anteaters. The unique structural peculiarity which they share is that the vertebræ of the back are fastened together successively by joints additional to those which exist in other mammals. It is curious that the opinion of the zoologist is reinforced by that of a practical hunter, who thought of a rare kind of armadillo, remarkable for possessing its bony skin plates only along the side and not on the back, that it was an hybrid between the armadillo and the ant-bear. Fundamentally related though the armadillo and the *Myrmecophaga* are, they are obviously most diverse in external form and feature. The immovable stolidity of the sloth and its comical face, the stately gait of the ant-eater and its huge bushy tail, contrast with the cheerful pattering waddle of the armadillo, sheathed in its thick armour. The armadillo—or, rather, the armadillos, for there are at least six distinct genera, many of which contain several species—has the unique peculiarity among mammals both living and extinct (with the single exception of certain armoured whales of great antiquity) of possessing a defensive armature composed of bony plates imbedded in the skin. But these bony plates do not make it a tortoise any more than the scales of the *Manis* make *it* a

lizard. They clash with a vast series of important facts which differentiate mammals from animals lying lower in the series, which have been already enumerated, and, quite apart from the fact that they differ in many details from the carapace of the tortoise or turtle, no more affine the two than does the beak of the tortoise, or the *Ornithorhynchus*, bridge over the gulf between those creatures and the bird. The huge, and we may almost say, " therefore," extinct, Glyptodons, which were allies of the armadillos, were boxed up in their carapaces ; the modern armadillos enjoy a freedom of movement within theirs, since the bony pieces are often distributed in bands. A species often to be seen at the Zoo, and known as *Tolypeutes tricinctus*, has its chest protected, as ought his to be who first crosses the seas, by a triple band, not of brass, but of bone. In others again there are six bands ; and the tiny *Chlamydophorus* (which will probably not be seen at the Zoo) has a point of likeness to the effete Glyptodonts, in having a rigid box enveloping it without jointing. So thoroughly movable are these bands as a rule, that the armadillo can roll up into a ball like its namesake, the armadillo woodlouse, and thus be with impunity played at ball with by a hungry jaguar, intent rather on solid food than playful trifling. Nor could the jaguar easily solve the difficulty by swallowing the armadillo like a pill. In its own choice of food the armadillo is decidedly a carrion lover, and approaches its food after the devious fashion of a burying beetle. Instead of openly making for the carcass, the armadillo circuitously tunnels underground and comes up underneath it. We are told that on the pampas a carcass is rarely found that has not beneath it a tunnel formed by some epicurean armadillo intent on luxury. At the Zoo this taste is severely restricted, and a diet of pap and chopped meat offered in its place. Mr. Hudson relates another way the armadillo has of providing itself

with meat. It will attack, and literally saw in two with the sharp edges of its carapace, a living snake.

The Pangolin

The pangolin is a corruption of the Malay word, "Tagiling," which is the vernacular name for an animal known to zoologists by the scientific name of *Manis*, and to us in general, as the scaly ant-eater. The genus *Manis*, of which there are some seven species, inhabits both Asia and Africa. It looks, as it has been well expressed, "like an animated spruce fir cone." The scales in fact with which it is thickly beset are brown and withered-looking, and loosely attached at the base in quite a vegetable fashion. They suggest that a good shake will scatter them. Nevertheless, the scales are very firm, and offer a double protection to their possessor. When harried and worried by a dog or other carnivore searching a meal, the scaly ant-eater rolls itself up into something like a ball, and presents a hard smooth surface to the enemy. Should the latter attempt a nearer investigation of the *Manis*, the scales contract still closer to the body, and often carry with them a fragment of flesh from the aggressor's nose, pinched off by their sharp edges. In two parts of the world, namely in Japan and in the Malay countries—perhaps, indeed, the legend has spread from the one place to the other—the *Manis* is believed to make another use of its scales. It erects them and then pretends to be dead. The inquisitive ant, in the fashion which everybody knows, wanders in multitudes over the body, and creeps between the scales. When a sufficient number of ants have thus begun to investigate the *Manis*, the latter closes his scales, and entering the nearest piece of water again erects his scales, and laps up the ants as they float out. The food of this

animal is entirely ants ; like the American ant-eaters, but unlike the African *Orycteropus*, the *Manis* has no teeth in its mouth, though the tongue is long and helped by large salivary glands. Like the American ant-eater, the *Manis* has a stomach which may be almost compared to a bird's gizzard. That is its walls are much thickened with muscle, and small pebbles seem to be also swallowed to help in crushing the food which in other animals is accomplished by the molar teeth. Though toothless as any hag the *Manis* triumphs over nature by adventitious help. It is said, however, to be a particularly stupid animal. When kept in confinement it wanders on at night in a straight line, like a Roman making a road, and if a chair happens to be in the way, climbs over it and falls down on the other side. All these ant-eaters are not purely ground-living creatures, like the aard vark. Many are, it is true ; and burrow therein to a very great length and depth. An Indian species makes a tunnel shelving downwards of twelve feet in length, and terminates it with a comfortable chamber of six feet circumference, to rest in. Some pangolins, however, climb ; and in these the toes are turned inwards and downwards as they are in the great American ant-eater. The largest *Manis* is six feet long ; and one species, which obviously had to be called *Manis macrura*, has the distinction of being one of not more than three animals which have the longest tails. In this animal the tail is nearly twice as long as the body. The same doubt surrounds the origin of the *Manis* as does that of the aard vark. Its birth is "wrop up in a mistry." And here again no fossils can be appealed to, to help us out of the *impasse*. The brain is not so helpful as it appears to be in the aard vark. There are, however, rather more grounds in this case than in that for linking on the *Manis* to the American ant-eaters, though, as already said, they are at present not entirely trustworthy.

A BURROWING EDENTATE

The Aard Vark

A sight of this undoubtedly one of the strangest of the mammalia will convince the observer of the justice of the Dutch name for it, viz. the "earth hog." It is also distinctly like the figure of the Devil in Albert Dürer's picture of Sintram. The piggish appearance is mainly due to the soft snout broadened and flattened at the end with the nostrils on the flattened region. The long ears, the "piggisneyes" and the somewhat sparse covering of hairs add to the likeness, and contribute towards the building up of a beast that, if it were figured as a "restoration" of some extinct form, would cause jeers at the expense of the draughtsman. Nature in fact in constructing the aard vark seems at first sight to have blundered. That will not be the view of anyone who has had the opportunity of watching the aard vard on its native Karoo. It buries itself in the earth with such rapidity, that it can only be followed by digging ahead in the presumed direction in which it is going. The *Orycteropus* is an underground creature living in burrows of its own excavation, which are thoughtfully and conveniently placed in the neighbourhood of the tall hills erected by the white ants upon which this ant-eater of the Cape preys. The body is eminently suited for burrowing for it dwindles at the two ends; the tail is but little distinct from the body, and has been correctly described as "a tapering of the body to a point." The deficient hairy covering is more than matched in another African and burrowing creature, the little rodent *Heterocephalus*. It appears that for burrowing animals the two extremes of hairiness are the most suitable. At one extreme we have *Heterocephalus* and the armadillos, and at the other the mole; but in the latter beast the fur is so dense and close that it presents an even surface comparable to nakedness. The reason for the extreme

is thus seen. *Orycteropus* feeds upon ants and it is said to impatiently thump with its heavy tail before commencing operations upon an ant hill; this throws the small inhabitants into such a panic that they run hither and thither in their confusion and pour out into the jaws of their foe. As it feeds on ants it is not surprising to find that *Orycteropus* has a particularly long and viscid tongue like the tongue of other formicivorous creatures. It is surprising, however, to find in its mouth, besides a long tongue, an extensive range of teeth. Other ant-eating creatures, for instance the anteater, have no teeth. One is disposed to wonder if this unexpected array of teeth is not an inheritance from the not very remote days when the *Orycteropus*, so to speak, chewed the cud like an ox. The mystery of its origin is one upon which but little light has been thrown. While the discovery of numerous fossil links bind together other groups of mammals, no such connexions are forthcoming in the case of our aard vark. It is an isolated and friendless type declining to be allied even to its neighbour, the *Manis* or pangolin. The old idea that it came near to the ant-eater of America has long since been exploded. Probably it is not an exaggeration to say that no two mammals are further apart than these two. The only hints that we seem able to get are in the brain. The nervous system generally among animals is an exceedingly conservative system, changing but slightly with other changes, and then showing up unexpected likenesses in beasts apparently remote. It has been pointed out that the brain of the *Orycteropus* is singularly like that of an ungulate animal; and it is perhaps to these creatures that *Orycteropus* shows the most likeness. In the meantime there are at least two distinct species of aard vark found in Africa, a northern and a southern form, while in former times, as shown by its fossil

remains, the *Orycteropus* was an inhabitant of the land of Samos and the kingdom of Persia.

Order Marsupials, or Kangaroos, Wombats and the like

The name marsupial indicates the most salient external feature of this order of mammals, viz. the possession of a pouch. Constantly it will be possible to observe this pouch in the case of kangaroos which happen to have young ones; for the infant kangaroo can be seen peering out of the maternal pouch. The reason for this pouch, or at any rate a fact which accompanies the possession of this pouch, is the very imperfect condition of the newborn young; they are tiny blind and naked creatures, not longer than the little finger. To the eye of the visitor this pouch is about the only visible character which links together the marsupial tribe. In other external features they differ very widely indeed. The long-legged, thick-tailed, leaping kangaroos with their long ears, and donkey-like face, are extraordinarily different from the fat marmot-like wombat, or from the comparatively recently discovered marsupial mole, the golden coloured, burrowing *Notoryctes*. The fierce Tasmanian wolf, Tasmanian devil, and ursine Dasyure, represent another type of this most diverse order, carnivorous in habit and with a smaller pouch backwardly directed instead of forwardly as in the kangaroos. The Phalangers of Australia and the Koala or "native bear" are soft-furred arboreal marsupials, quite as different in external appearance from any of the types that have been mentioned, as are the latter among themselves. The American opossums are different again; and another extreme of this curiously diverse order is realized by the tiny "flying" forms which skim from branch to branch like the flying squirrels of the order Rodentia.

All these marsupials possess also a pair of bones diverging from each other like a " V ", which support the walls of the pouch, and are not found in any of the higher mammals. These can be easily felt through the skin ; and though it has been said that the dog possesses a similar pair of structures, it is not by any means clear that there is a real correspondence. It will be noticed that these bones, although they support the wall of the pouch, are not in the least developed to that end ; for they occur in the male as well as in the female. With the exception of the American opossums and a small creature known as " Raton runcho," or technically as *Cænolestes*, the marsupials are at the present day only found in Australia and some of the islands to the north of that continent as well as in Tasmania in the south. They do not get to New Zealand, which is an island without indigenous mammals at all except a bat or two.

The Giant Kangaroo

One of the principal improvements at the Zoo of late years has been the formation of a respectable paddock for the enjoyment of the leaping kangaroos, who can now show us something of their strength and agility. Formerly the cooped up series of backyards in which they vegetated gave no chance to realize that a kangaroo can clear at a single leap a space of some twenty feet. The kangaroo is certainly like no other animal, except, of course, its own immediate relatives the other kangaroo-like genera. Its rather small head with long ears is not unsuggestive of that of a donkey ; it has a mild look which is not an index of its nature, for the kangaroo when at close quarters and with its back against a wall is not by any means a mild antagonist. The body with its huge tail, powerful hind legs, and diminutive fore limbs is only paralleled by the jerboa

KANGAROO

To face p. 140]

and the jerboa-rats of Australia, and by the Cape jumping hare (*Pedetes caffer*) of Africa. To be agile, to traverse arid wastes in the search for water or for herbage, with rapidity, is a *sine quâ non* with all these creatures which have a partiality for plains, and arid ones at that. It is interesting and most instructive to note how differently in such cases the feet have been constructed for the due carrying of their owners over the ground. In the ungulates either the middle toe or the third and fourth has or have been especially strengthened to meet the demand. In the jerboa the Perissodactyle type of foot has been, we must suppose, quite independently acquired; for in them digit number three is in the middle and strikes the ground first. In the kangaroos, on the other hand, it is the fourth toe which is predominant; and it is, as may be easily seen in the living animal, particularly strong and furnished with a huge nail. In bipedal man it is the innermost toe, the first, which mainly bears the weight of the body. There is thus nearly every possible arrangement, which varies according to the group. In the kangaroo the peculiarly tiny third and fourth toes will be noticed to be tied up in a common integument. How thick blood is among the marsupials is shown by the fact that in the phalangers, arboreal creatures quite unlike the kangaroos in general aspect, the same toes are similarly swathed in skin. There are between twenty and thirty kinds of kangaroos, including the so called wallabies which are not now distinguished from the kangaroos; the only difference that ever existed was merely one of size.

The Tree Kangaroo

The idea of a kangaroo up a tree suggests a purely metaphorical use of the term to most persons for whom

kangaroos are essentially ground-hopping creatures. Nevertheless there is a whole genus of kangaroos known by the technical name of *Dendrolagus*, which name, it will be observed, expresses the fact of their arboreal proclivities, whose life is spent hopping along branches and not bounding over the grass. There are about three different species of these tree kangaroos, of which a new one has been lately found and named after the traveller Lumholz. The build of the kangaroo does not seem at first sight to be suitable to nice balancing and clambering upon branches. Yet it is highly interesting to notice how, with the minimum expenditure of energy in the way of alteration, Nature has been able to convert a purely terrestrial animal into one which is as distinctively arboreal. The long tail remains; but it is furry throughout and of somewhat more slender dimensions; it is no longer wanted as a prop for the animal when progressing slowly along the ground. It rather serves the *Dendrolagus* as a balancing pole to aid in its successful leaps from branch to branch. And for this purpose it need not be quite so massive and so comparatively short-haired as in kangaroos and wallabies. The toes also, which have greatly prolonged nails in the leaping kangaroo, have these nails much shorter in the tree-frequenting beast. The fore limbs, too, are rather longer in proportion than those of kangaroos; otherwise there is but little change in habit. *Dendrolagus* has the mild somewhat asinine features of kangaroos, the same two projecting under incisors like French caricatures of the English "Mees," which it is to be presumed can work upon each other like the blades of a pair of scissors; they can at any rate in the common kangaroo, a fact which was shown a good many years ago. In short, there is nothing of far reaching importance either externally or internally, that differentiates this creature from other kangaroos.

BURROWING MARSUPIALS

Wombats

The Zoological Gardens are rarely, if ever, without these fat somewhat uncouth marsupials, suggestive of an overgrown marmot. They are coarsely hairy, and waddle when unexcited, though when needs must they can run with some rapidity. The stumpy tail heightens the likeness to the European marmot, as do also the strong and rodent-like incisor teeth in the front of the jaws. In fact, as has been often pointed out, the wombat is an excellent example of what is known as convergence; starting from a totally different place in the order of nature it has arrived at much the same goal as has the marmot or some such burrowing rodent. It walks heavily on the flat of the feet, and eats roots for which it digs. In the burrows there is some degree of sociability exhibited; and this again is a rodent-like character. One has only to recall the prairie marmots, and the vizcachas of North and South America. It has, however, the pouch of the ordinary marsupial pattern; and its young are doubtless born in imperfection as those of other marsupials, though that matter is for the present shrouded in some obscurity. Although nocturnal in their native Australia and Tasmania, the wombats at the Zoo show themselves during the day like other nocturnal beasts do in that institution. Like many other marsupials, the "pouched mouse," to translate its scientific name of Phascolomys is for the most part silent; it is not without interest that silence is apt to be an attribute of primitiveness and chatter due to higher specialization. We all of us know the silent man whose few recorded words were not indicative of great brain power. Anyhow newts are silent and so are reptiles and many of the older types of birds, while the marsupials and rodents and insectivores carry on the generalization into the mammals. At times, however, the wombat hisses; one species is said to

give vent to a "groan." In captivity it is as a rule amiable, the amiability being possibly associated with stupidity. Sir Everard Home, however, the famous surgeon and anatomist of the end of the eighteenth and beginning of the nineteenth centuries, thought the wombat not unintelligent though he agreed from personal observation as to its amiability.

The Vulpine Phalanger

The vulpine phalanger is not especially fox-like in aspect though it has somewhat of the sharp-snouted eagerness of that animal, toned down, however, by marsupial stupidity. *Trichosurus vulpecula* (between this name and *Phalangista vulpina* choice may be made) has departed considerably from, or rather has not nearly arrived at, the kangaroo type of structure. Still there are numerous facts which show it to be allied to the kangaroos. For instance the second and third toes are bound together in a common integument as in the leaping and long-tailed Diprotodont; and it has the same strong lower incisors which, however, it is alleged, do not meet and move upon each other in the scissors-like way that has been recorded in the grazing kangaroos. *Trichosurus*, in fact, is purely arboreal, though it will at times descend to the ground; on these occasions it walks in a flat-footed and archaic way. It is, however, most suited to a life in trees, and it has as an aid to effective climbing, a prehensile tail, so common a feature in tree-dwelling animals. It chiefly affects the blue gum tree of its native Australia and eats the leaves and shoots of that tree, occasionally varying its diet, as is the way with many vegetable-feeding animals marsupial and otherwise, with animal food. In captivity small birds are enjoyed by it. It is often called "opossum," but it has of course nothing to do with the opossums of North and South America,

save the bare fact that it is, like them, a marsupial. The real and genuine opossums belong to the carnivorous section of the marsupials, the Polyprotodonts. They are, however, tree climbers and have the same prehensile tail and sharp claws which distinguish our *Trichosurus*. The pouch of *Trichosurus* only harbours at most two young ones and more usually one only. It has not the often enormous philoprogenitiveness of the "'possum." In Australia and Tasmania it is hotly pursued on account of its moderately valuable fur. This is its attraction to the white man. The black man thinks less of the fur than of the flesh beneath it, and regards *Trichosurus*, in spite of its rankness in the European nostril, as desirable meat.

Belideus Breviceps

We must not leave the diprotodont marsupials without a reference to the flying forms of which the present representative (also called *Petaurus breviceps*) is often to be found at the Zoo. It is a small, soft-furred, mousy-looking creature of grey colour with a black stripe down the back. It is not more than eight inches long and has a bushy tail of about the same length. The term "flying" as applied to these phalangers must not of course be taken literally. They cannot soar upward like a bird; the most that can be done is a series of skims from bough to bough, the distance to the ground being lessened at each effort. The flying, such as it is, is effected by a parachute-like membrane attached along the sides of the body between the limbs. It seems to be likely that all kinds of flying really originated from some such mechanism, which gradually became restricted to the fore-limbs in the more perfectly flying birds and bats. A loose fold of skin at the sides is sufficient for a beginning; this becomes intensified, and then the "patagium" in birds is limited to the

front of the fore limbs, a trace of the primitive lateral membrane being left in what is called in those animals the metapatagium. There is a kind of a hint that in the earliest known bird, *Archæopteryx*, a lateral feathered membrane existed besides the special patagium with its feathers in front of the fore limb. A remarkable fact about these small flying phalangers is that the power of flight appears to have been independently produced more than once in the group. For we find several types of them each of which is separately related to a non-flying form; we suppose, therefore, that each has been evolved separately. The same conclusion can be come to with regard to the flying squirrels, real squirrels that is to say, for the marsupials which we are now considering are sometimes termed flying squirrels. In *Sciuropterus* and *Anomalurus*, of which the former is often to be seen at the Zoo, we have parachuted squirrels not nearly akin to each other, and therefore possibly to be derived from different forms of merely arboreal squirrels. The carnivorous polyprotodont marsupials have not as yet produced any flying forms.

The Tasmanian Wolf or Thylacine

This wolf-like creature is not a wolf but a representative of the polyprotodont section of the marsupials, called polyprotodont because the lower incisors are numerous instead of reduced to two as in the vegetable-feeding diprotodonts. The thylacine and its polyprotodont allies show another feature, not found in any other mammals, except the whales, and that is that the total number of the teeth exceed the normal forty-four. This is the original number of teeth, as it appears, in the higher mammals, as testified to by various extinct forms; from this perfection of tooth numbers most living mammals have degenerated. Another feature

about this and of course other marsupials is the existence of a pouch; but the thylacine is remarkable in the fact that the male has very considerable traces of this pouch, which are not, however, large enough to render it a functional organ for the protection of the newly born young. The name thylacine signifies, of course, pouched dog. The inhabitants of Tasmania call it also tiger and hyæna, these names being suggested by the transverse stripes upon the body. It is more like a dog than anything else; its head is long with a long muzzle, and the skull at first sight is so like that of *Canis* that it was frequently used as a "catch" in examinations. The proper marsupial characters are there, but masked by superficial resemblances. The thylacine is now limited to Tasmania, and it has been suggested that the advent of the dingo dog, which accompanied as is thought the Australians in their wanderings, is partly responsible for its disappearance from the mainland of Australia, where it once lived. Its days will probably not be long in the land where it now abides; for it has the pernicious habit of sheep stealing and the further habit of killing a new sheep each time that it feels in want of a snack. So the Tasmanian farmers, probably influenced more by economic than zoological considerations, will see to it that the thylacine does not multiply excessively. It has, however, this advantage in battling for life with the colonists, that it apparently can produce four young at a birth. We have spoken of the superficial likeness which the thylacine bears to a dog. This likeness is more apparent in stuffed animals than in the live Tasmanian wolf. The spry alertness of the dog is replaced in life by a gloomy, distrustful, and unintellectual appearance, which is most unsuggestive of any dog. The thylacine has a curious habit which has been lately adverted upon. When standing at ease it plants down

its tail firmly so that it forms a support for the body. This is quite analogous to the support given to the kangaroo by its tail.

It has been remarked that the thylacine shows a preference for mutton over any other article of diet. Before Van Diemen's land was discovered there were plenty of thylacines but no mutton. In those days it had to content itself with marsupials only ; an observer, however, has stated that nowadays its palate has been so vitiated by civilization that it will not satisfy a healthy appetite by devouring the wombat, which often occurs in plenty near to its haunts. But on the other hand a spiny ant-eater (Echidna) was once dug out of the stomach of a thylacine, showing that when pressed for food it is not particular. The first specimens ever acquired by the Zoological Society came over in the year 1850. They were shipped in company with twelve fat sheep to serve them on the voyage. The next thylacines were procured in 1863, and then until 1883 there were no specimens of this animal procured for the Zoo. Since that date, however, there have been several ; and it is possible always at any given time to find in the Gardens this the largest of existing polyprotodont marsupials. It is more likely, however, that several of its allies, such as the dasyure and the American opossums will be on view.

Order Monotremata, the Echidna and the Ornythorynchus

In the general sketch of mammalian organization we have dealt with this group, which occupy most certainly the lowest position among the mammalia and still retain more than one early and non-mammalian character in their anatomy.

The Australia Ant-eater

This animal is undoubtedly Australian and is also an eater of ants, and yet the name seems ill chosen, for it suggests a comparison with the ant-eaters of America and of the Old World. *Echidna* has nothing whatever to do with those Edentates since it belongs to a quite different order whose general characters have been sketched out. Of *Echidna aculeata* there is as a rule, or at least often, a specimen to be seen at the Zoo. Its general characters mark it out as distinct from any other mammal, from which indeed it can readily be differentiated without having recourse to its skeleton. The long and toothless snout recalls the *Myrmecophaga* and the Old World *Manis*; and a long and viscid tongue protrudes itself in the same way from these toothless jaws. But the body is covered with a dense covering of sharp spines, mingled with hairs, in a fashion more like that of the hedgehog than of any other mammal. The ways of the *Echidna*, when in search of termites, are much those of its ant-eating representatives in other countries. Its stout claws are able to make a breach in the walls of the fortress manned by the ants, and into this breach it thrusts its long tongue and waits until the exploratory and indignant ants have limed themselves thereon. In default of ants the *Echidna* will put up with worms, and larvæ, which it extracts by means of the same long and thin tongue, which can be inserted into crevices and can draw therefrom the lurking insect. Nature has tempered the wind to this exceedingly unshorn lamb by endowing it with a nocturnal way of life, and with a liking for concealment in thick scrub. But even this does not entirely free it from persecution. For in spite of its spines the thylacine, as we have already said, has been known to swallow a spiny ant-eater whole, just as the leopard in India will grapple with the equally spiny porcupine. The

Echidna moves with a shuffling gait and walks badly upon the sides of its feet. This is precisely the way in which the *Myrmecophaga* walks, and in both cases the habit has at least the result of preserving unimpaired the sharp claws so necessary to dig down the foundations of ant-hills. Everybody knows nowadays that this mammal lays eggs. And furthermore as in other egg-laying vertebrates, the young, when ready for hatching, has a knob on its snout which enables it to break the shell and emerge into the world. When it does emerge it is still taken care of by the mother, who keeps it in her pouch for certain time, and afterwards allows its out for a run and at stated intervals picks it up again and puts it in the pouch to be fed. When the mother intends to rove far she thinks of her infant and places it securely in a burrow dug for the purpose. It is a very interesting fact that an abundance of termites in various parts of the world has resulted in the modication of such diverse types of animals for their enjoyment. The *Echidna* was made for the termites, not the termites for the *Echidna*.

CHAPTER VI

Birds

THE most uninitiated can recognize without the faintest difficulty the characters that distinguish birds from other animals. But it must not be assumed at once that to define them as feathered bipeds is quite enough. For, to begin with, birds are scaly as well as feathered, thus showing a glimpse, externally visible, of their unquestioned relationship to the lower lying reptiles. The feet are always scaly, in parts at least, and generally entirely so. Anyhow, no creature that is not a bird has feathers or even anything at all approaching to feathers, in nature; and *per contra*, no bird is without feathers. More than this, all birds possess wings, even the wrongly called *Apteryx*, which has tiny wings concealed beneath its feathers. The term wing here, it will be observed, does not necessarily mean an organ of flight. Though all birds possess wings, all birds cannot fly. Besides the *Apteryx*, the ostrich tribe generally are purely cursorial, and so are certain rails and one or two other birds. What is meant by wing in this sense is a fore limb, actually and accurately comparable to the arm of man or the fore legs of a cat, in which the number of fingers is reduced from five to three, and the proportions of the remaining bones is somewhat altered from what is found in reptiles and mammals. This being the case, all birds are bipedal, which is another distinguishing character, though it is

very faintly discounted by the fact of the "quadrupedal" movements of the young of the Hoatzin and a few others. No birds have teeth; that is, no living birds, for a few now extinct forms had these structures. Every bird has a horny beak, which in some sense stands in lieu of teeth. It is noticeable that birds have an erect and alert attitude, which contrasts with that of the gloomy reptile. The eyes are clear and open, not closed, except, indeed, during actual sleep, in a drowsy fashion. Hearing as well as sight is well developed, and, indeed, the only sense in which birds are as a rule rather deficient is that of smell; but some experiments have gone far toward showing that after all, birds can detect varying odours rather more accurately than has been supposed. In external form birds are most obviously built upon one common plan. This is recognized in popular parlance by the fact that a given bird is apt to be spoken of merely as a bird, while a mammal is more usually classified roughly; it is spoken of as a cat, or an elephant, etc. The flight of birds, as well as their lightness of movement when hopping upon the ground or among trees, is a characteristic of the group, and is associated with air spaces which ramify among the organs of the body and in the substance of the bones. These air spaces are outgrowths of the lungs; and while they assist in producing a light frame suitable for flying, must also, one would imagine, improve the respiration of the creatures by bringing air into contact with the entire system. No living reptile or mammal has anything approaching to this aeration of the body. It is possible, however, that certain extinct reptiles, particularly the flying Pterodactyles, had something of the kind; so too had, in the opinion of most, the hopping and often gigantic Dinosaurs of the past. Associated with, and perhaps due to, this is the hotbloodedness of birds. Their temperature is higher

than that of mammals, and the older authors saw in this physiological likeness a reason for associating together birds and mammals. Every fact of structure, however, contradicts such an association, which is nowadays held by no one acquainted with the facts. But, on the other hand, the nearness of the sprightly, intelligent bird to the sullen and unintelligent lizard has been perhaps a little overrated. The group of birds, in fact, is a group which is quite equivalent to that of reptiles on the one hand and to mammals on the other; but the two first are rather nearer to each other than either are to birds. In fact, the common starting point of both birds and reptiles was, as far as we can see, something in the nature of a very simply organized reptile. To return, however, to our living birds, with which alone we are concerned here. It will be noticed, particularly well in the case of a long-legged bird such as a crane or stork, that when a bird is standing upright it stands upon its toes only. Above the toes, which are either three or four in number, with a few exceptions, such as the ostrich, is a long bone which is not, as might be supposed, the equivalent of our shin bone. This long bone is in reality the ankle bones, *plus* what are technically termed the metatarsals, i.e. those bones which in ourselves lie between the ankle bones proper and the phalanges or bones of the toes themselves. In the human foot the phalanges are the separated toes, while the metatarsals occupy the greater part of the foot. Birds, therefore, have this region of the foot enormously elongated. But the feature is not absolutely distinctive of them, since even in mammals which walk upon their toes, like the horse, the metatarsals are also long. There are other instances of the same elongation of the middle part of the foot.

All birds, so far as is known, lay eggs, from which are hatched in due course young birds that resemble their

parents much more closely than do the newly hatched young of the majority of the Amphibia. No bird is ovoviviparous, as are some reptiles. Moreover, as a very general rule the eggs of birds are not merely dropped promiscuously, but laid, sometimes even in a regular position, in definite nests; these nests are often complex structures of some architectual pretensions. The eggs are for the most part coloured, while the eggs of reptiles are never coloured, but always white. A good many birds also lay white eggs. While a reptile emerges from the egg in the likeness of its parents, the young bird does show some differences from its parents, though these are never of a kind such as to justify the use of the term larva for a newly hatched bird. The only suggestion of a larval form among birds is perhaps the Hoatzin, where the mobile fingers with well developed claws at the ends are organs modified for the purposes of the nestling, and thus just come under the category of what is meant by a larva. All these facts, except perhaps the last, are familiar enough to every one; but it is just as well to emphasize them in order to point out the distinctions between birds and other vertebrated animals. Newly hatched birds differ in different cases. In some species they are completely nude and devoid of feathers. In others they are covered with down, which is shed by being thrust up upon the tips of the subsequently produced nestling plumage, which itself gives way later to the final and annually deciduous plumage.

The twittering and "cheeping" of the young is succeeded in many birds by a most elaborate voice, produced by the movement of a vibrating membrane at the junction of the two bronchi, into which the at first single air tube (trachea), leading to the lungs, divides. More is said of the bird's voice later. In the meantime, it is as well to note that the possession of a voice of the kind which reaches its maximum for

beauty and variety in the nightingale, is a character of birds which is not found in any reptile or indeed in any other vertebrate, in spite of Mr. Ruskin's singing serpents! There are more kinds of birds in the world than of any other group of vertebrated animals, very many more. They are the insects among vertebrates by reason of these numbers, and of their gaudy hues, also unequalled in generality of occurrence and in variety among other vertebrates.

In spite of their general uniformity, the "aery caravan" can be divided up into a number of distinct groups, which, however, have by no means the value of the major, or even of the minor, subdivisions of the mammalia or of the reptiles. The range of structural variation among birds is possibly about equal to that of the lizards among reptiles, or of the frogs and toads among Amphibians. We may acknowledge the following groups, to which we shall not apply the term orders, as that would suggest an equivalence with the orders in the mammalia: (1) *Passeres*, all the small perching birds, such as crows, thrushes, wagtails, birds of paradise, swallows, etc., etc.; (2) *Pici*, that is, woodpeckers, barbets, and toucans; (3) *Alcedines*, including kingfishers only; (4) *Colii*, an assemblage of very limited extent, confined to the African mouse birds or colies; (5) *Trogones*, the American and Afro-Asiatic trogons; (6) *Coraciæ*, i.e. rollers, bee-eaters, motmots, todies, puff birds; (7) hornbills and hoopoes constitute the group *Bucerotes*; (8) *Macrochires*, humming-birds and swifts; (9) *Caprimulgi*, goat suckers; (10) *Striges*, or owls; (11) *Psittaci*, or parrots; (12) *Cuculi*, cuckoos; (13) *Musophagi*, touracous; (14) *Opisthocomi*, the Hoatzin only; (15) *Galli*, the gallinaceous birds, pheasants, curassows, turkeys, megapodes, guinea fowls, quails, etc.; (16) *Columbæ*, pigeons; (17) *Pterocletes*, sand grouse; (18) *Turnices*, the quail-like birds *Turnix*

and *Pedionomus*; (19) *Ralli*, rails and coots; (20) *Otides*, bustards; (21) *Limicolæ*, snipes, plovers, curlews, etc.; (22) *Alcæ*, auks, guillemots; (23) *Grues*, cranes, the New Caledonian kagu, the American cariama, the trumpeters and the sun bird Eurypyga; (24) *Colymbi*, divers and grebes; (25) *Sphenisci*, penguins; (26) *Steganopodes*, pelicans, cormorants, etc.; (27) *Herodiones*, herons and storks; (28) *Tubinares*, albatross and petrels; (29) *Palamedeæ*, screamers; (30) *Anseres*, ducks, geese, and swans; (31) *Accipitres*, eagles, vultures, hawks; (32) *Tinami*, tinamous; (33) *Struthiones*, ostrich tribe. In the following pages will be found accounts of birds belonging to the majority of these groups.

The Cow-pen Bird

The enormous preponderance of Passerine birds over all others is shown by the fact that in the list of animals published by the Zoological Society, no less than 516 species out of a total of 1,676 are members of the Passerine group, which are, or have been, on view in the Society's menagerie. This being the case, we cannot hope to give an adequate idea of their endless variety of colour and, though to a much less extent, of form, but must content ourselves with saying something about one or two types only. Passerine birds do not run large. The biggest is the raven; but they are some of them excessively small, though the humming birds seem to include the smallest members of the bird creation, and the humming birds are not Passerine, but members of a distinct group. In the Passerines the organ of voice, or the syrinx, to use Prof. Huxley's term, reaches its highest complications in the way of structure and consequent efficiency as an organ of sound-production. A larger number of muscles, each moving the sound-producing membrane and the cartilages to

which it is attached in a slightly different fashion, and thus ensuring variability of sound, exists in the Passerines than in any other birds. The birds that come nearest to them are the parrots, with whose powers of varied utterance every one is familiar. It is curious that perfection of voice organ does not go hand in hand with variability of voice. The hoarse crow and the melodious nightingale have a practically identical syrinx. But then, after all, the voice of the prima donna is more flexible and varied than that of the itinerant vendor of cat's meat, though both have a voice-producing organ of identical structure. Externally the Passerinea are to be detected by the four toes, of which the hind toe is very prominent and turned backwards, and by the fewness of the scales upon the legs. With this much by way of a preface we shall consider a typical Passerine bird, the cow bird, or more correctly the cow-pen bird, so called on account of its fondness for visiting cow-pens. This bird, known to science as *Molothrus* (or, more correctly, as it appears, *Molobrus*, the former name having been originally a misprint) *bonariensis*, is black in hue throughout, and is naturally also called the blackbird. It is of about the same size as the blackbird of this country, and is like it, a typical Passerine, with the same voice organ and structure in general. It is, indeed, the habits and not the structure of this bird which are so interesting and unexpected. Every one knows of the parasitic way of life of the immoral cuckoo, who entrusts to strangers the rearing of its young, and who, besides thus evading the duties as well as the pleasure of maternity and paternity, is, when young and in the foreign nest, a bloodthirsty tyrant to its fellow nestlings ; these, the rightful owners of the nest, it turns out and leaves to die upon the hard ground beneath. This very same habit is inherent in the *Molothrus bonariensis*, and in some of the other species

of the genus. Moreover, just as a criminal will practise upon his own class, just as there is no honour among thieves, but thief will rob thief, so one species of *Molothrus*, viz., *M. rufo-axillaris*, will lay its eggs in the nest of *M. badius*, a form which is not itself parasitic. Nature has aided and abetted this iniquitous mode of life in many and varied ways. These have been carefully studied upon the spot by Mr. W. H. Hudson, from whose account of the same in the *Proceedings* of the Zoological Society we shall quote. The cow bird appears to have adopted the habits of the cuckoo at a later period in the history of its race than that bird, for it often makes rather serious mistakes. For example, *Molothrus* has been known to drop its eggs on the ground, omitting to remove them carefully and subsequently in its bill to some adjacent nest, as does the cuckoo. Its instincts are as yet so primitive and uncultured that the bird will lay its eggs in an old and deserted nest, or fail to hit the right time for egg laying, when its young, being born too late, perish of neglect at the hands of their foster parents. This latter error, however, appears to be remedied by the fact that the young are hatched especially early, and are also peculiarly strong. *Molothrus*, when it does successfully lay its eggs in a stranger's nest, is apt to make assurance doubly sure by pecking at and destroying the legitimate eggy occupants of the nest; in doing this, it will occasionally peck at its own eggs, or rather those of another *Molothrus* who has been beforehand with it. This danger to future generations of *Molothri* is to some extent evaded by the very hard nature of the shell, which resists pecking more efficiently than do the eggs of the unconsulted hosts. The cuckoo's eggs, as a matter of quite common knowledge, are varied in hue, so as to give them a better chance of escaping unnoticed in the nests of their unwilling hosts. Precisely the

same variation in colour characterizes the eggs of *Molothrus bonariensis*, which range from pure white through a spotty condition to eggs of a fine red throughout. Another fact which seems to show the comparative recentness of the parasitic habit is that *Molothrus* occasionally builds nests for itself, and inspects and shows a general interest in the nests of other birds, sometimes even altering their structure and adding a finish.

Bower Birds

The last compartment of the Western Aviary has for a long series of years always contained examples of the bower bird (*Ptilonorhynchus violaceus*), and, as a rule, at least some attempt is made every year by these birds to construct the " bowers " which are known, by name at least, to most persons. This and the other kinds of bower birds are Passerine birds with no special features of structural interest except the difference, so marked, in the coloration of the two sexes. In the present species the male is a glossy violet shot black, while the female is a speckly greenish. It is the minds, however, rather than the bodies of these birds which are of such great interest, and so hard to understand. It is invariably the case that when there is a considerable difference of appearance between the two sexes, when sexual dimorphism, as it is called, occurs, that the male bird is the more brilliant in its hues of the two, and that its brilliancy of hue is emphasized by various antics which are performed in the breeding season; this behaviour is, it is thought, for the delectation of the hen, and as an attempt to gain her favours at the exexpense of a less ably performing and duller-hued rival. As a matter of fact, such performances are not exclusively indulged in at the breeding season by all these diversely coloured birds. With the bower bird this

behaviour is complicated by a course of action which was first made known by that well equipped ornithologist, the late Mr. Gould, who went to Australia in 1837 for the joint purpose of collection and observation. The male builds with some little, but not much, assistance from the female, whose main rôle is to look on and admire, a kind of archway or bower made upon a platform of twigs by other twigs, interlaced where they meet at the top. Round and in this are scattered attractive objects, coloured, or startling by their whiteness. Bleached bones and gaily coloured shells and pebbles combine to form an æsthetic playing ground. Round and through this the male rushes in amorous play, delighting the female by his beauty and activity. It is thought that the love of the little jackdaw for the cardinal's ruby ring is a germ of the same, and in the bower bird more fully developed, habit. The nest, it should be remarked, has nothing to do with the bower; it is constructed for business purposes only, and is plain and unadorned.

The Green Woodpecker

Woodpeckers are numerous, wherever there are trees, in nearly all parts of the world; but they do not occur in Australia, or in that peculiarly peopled island, Madagascar. Woodpeckers are apt to be gay in colour, and of all colours. Green, red, yellow, pure white, and more dingy hues ornament the birds. Our own green woodpecker (*Gecinus viridis*) is a good type of the race to consider more closely; and, indeed, one woodpecker is as good as another, or nearly so, to illustrate the peculiarities of this rather sharply marked off group of birds. A thick strong bill and (save in one or two kinds) four toes, of which two are turned forwards and two backwards, thus affording a strong grip upon the bark

of a tree, characterize these birds. The green woodpecker, which the Nature writer genially calls " Yaffle," is a denizen of most parts of England, and is one of our handsomest birds, green, with a yellow patch upon the back and red streaks on the head. It frequents trees, as do other woodpeckers, and extracts from crevices by means of an extraordinarily elongated tongue (another character of the family Picidæ, but not of the rest of the group Pici) insects, upon which it feeds. The " tap, tap " of the woodpecker—which, as a matter of fact, seems to be usually the nuthatch, not the woodpecker —is, in spite of Henry Kirke White, not applied to " the hollow beech tree." It has been justly pointed out that this is the one tree not at all suitable to woodpeckers, for the bark clings tight and does not furnish crevices wherein may lurk insects. The variant " hollow elm tree " of the undertaker in *David Copperfield* is better. The bill as an instrument serves the woodpecker for another purpose besides dislodging insects. With this heavy combined hammer and chisel the bird excavates a hole for its nest. In the hole are laid the white eggs which characterize this, as they do so many birds which deposit their eggs in concealed situations. The woodpecker exhibits the truth of the oft-quoted half line, " Sic vos non vobis," for, after the woodpecker has arduously excavated a suitable cavern, a pair of starlings at once take possession of it for *their* nursery. The somewhat mocking cry of the green woodpecker has been rendered " glu-glu-glu-gluk." It seems that there are about 350 known species of woodpeckers in the world, but only three of these live regularly in this country, though the number may of course be increased by casual visitors. Anatomically the woodpeckers seem to come nearest to the toucans and barbets. But they are a very clearly marked family, notwithstanding.

THE HORNBILL

The Rhinoceros Bird

In the East, where alone they live, the hornbills are often called toucans, which is an unnecessary con-

HORNBILL.

fusion between two perfectly distinct kinds of birds. The exclusively American toucans have, it is true,

prominent bills like the hornbills of India and Africa; but their feet have the toes in twos, one pair behind and one in front; they are like the cuckoos and some other arboreal birds, "zygodactyle." The hornbills have a foot which is efficient for grasping purposes, but three toes closely applied look forwards and only one backward. Still, the two families of birds are not very remote, and the one takes the place of the other in forests of the tropics of New and Old Worlds. You can tell a hornbill, as its very name denotes, by its huge bill. This would seem to necessitate an unusually strong head to sustain it. As a matter of fact, additional resistant power is arrived at in these birds by a complete fusion between the two first vertebræ of the neck, which are in nearly all other birds separate and moveable, the one upon the other. Besides, the conviction of impossible top-heaviness forced upon the uninformed mind by the look of a hornbill is dissipated when the dried skull of one of these birds is inspected. It is then seen to be formed of the most delicate bony substance, arranged in a loose network of bony thread. To watch a hornbill hop lightly from bough to bough finally sets the mind at rest, and shows that Nature here, as elsewhere, has known what she was about in framing the hornbill. The bizarre suggestion of the bill, with its superincumbent casque (not present, however, in all hornbills), is not borne out by an acquaintance with the way of life of the bird. It lives largely upon fruits, which a long bill enables it to wrench off from their native branches, the leverage being thereby increased. Large though these birds are, they are exceedingly light, and for reasons revealed to the anatomist. When a hornbill is dissected, it is only necessary to remove the skin from the leg, when all the muscles, nerves, and vessels stand out as if separated by painstaking use of the scalpel. The reason for this is that the flesh is dry,

like that of a hare or an antelope, and air spaces traverse the body throughout. The bodies of all birds are aerated by expansions of the lung; but the hornbills are particularly so, and the absence of fat conduces to this spareness of appearance. Their flight appears heavy in spite of this, and they make a great deal of noise, especially at getting off, which has been compared by Dr. Russell Wallace to the puffing of a steam engine. It is not all hornbills that lead an arboreal life. In Africa are at least two different species of ground hornbills, which are rightly placed in a distinct genus and termed *Bucorax* and *Bucorvus*. Their beak is not quite so huge as in the more exaggerated form in which it is found in *Buceros* and its allied tree dwellers. But it is still of respectable dimensions. *Bucorvus* sidles and prances with some stateliness, and, instead of living upon fruits, catches reptiles. It is not unraven-like in aspect, and is distinctly intelligent, to judge from the numerous specimens which have been on view at the Zoo in late years. The gait of this bird has produced some alteration in the structure of the foot. It is still of the pattern of its tree-frequenting relatives; but the inner toe of the three forwardly-directed ones has a much more massive formation than that of *Buceros*, and is of greater length. It is noteworthy that the same effect has been produced here as in man compared with the arboreal apes. Our great toe is the strongest of the toes, and bears most of the weight of the foot. So in the *Bucorvus* it is the physiological equivalent of the great toe which is correspondingly increased, for the real big toe is turned back. Now in ungulate animals which are also digitigrade, pressure upon the foot is associated with the disappearance of the outer toes and the predominance of the middle toe or toes. It is in some of its breeding habits that the hornbill is so remarkable and different from other birds.

Buceros and its allies lay white eggs and deposit them in a hole in a tree. It has been pointed out that birds that lay white eggs generally deposit them in a situation remote from the light. But this is by no means universally true. Some exceptions referred to in the present book are certain cuckoos and the podargus ; there are others. Still, the hornbills conform to this partial generalization. When the time has arrived for egg-laying and incubation, the male bird carefully plasters up his wife within her dwelling and takes upon himself the care of feeding her. He remarks, in effect, that she must attend to her family and not gad about ; but at the same time does not spare himself, for males in the breeding season are frequently in a miserable physical condition. They are merely, as it has been expressed, a bag of rattling bones. On the other hand, the newly hatched young are little lumps of fat and jelly, featherless, and impotent to help themselves. This careful guarding of the family may be a defence against the prowling and marauding cat, as well as other carnivores and snakes. It is certain that the visitor will find several hornbills at the Zoo. There are in Nature more than sixty species at present known.

The "More-Pork," Cuvier's Podargus

Aristophanes made birds talk, and so too did Chaucer. This practice is continued by those who in modern times have invented pseudo-vernacular names for birds based upon their supposed utterances. Some of the remarks thus put into the mouths of the feathered creation have a point, others have not. As an instance of the latter is a weird-looking bird of which there have been several examples at the Zoo, the last but one of which was harboured in the insect house. This bird, *Podargus cuvieri,* is one of the churn owls or goatsuckers, and is a

native of Australia. The goatsuckers, or Caprimulgidæ, show characters which are magnified in the *Podargus*.

THE " MORE-PORK."

They have enormous mouths, which are carried agape in their flight and catch innumerable insects. The bill is small, since it is not needed as an assistance to feeding or fighting, the two principal occupations of the " lower " animals. The plumage of *Podargus* is, as is that of other goatsuckers, a soft mixture of browns and greys, a " crepuscular " hue, in fact, which assorts well with a nocturnal life. The " More-Pork " looks something like a caricature of a bird by Lear. Its head is enormous, and its body shrunken. A pair of large yellow eyes complete a picture which is ludicrous. One specimen at the Zoo was fed with new-born mice, which were gulped with ease down its huge throat. In Australia it feeds on insects. The proper name of this bird appears to be *Podargus strigoides*, and the name is suggestive of the resemblances of the bird. Since the owls have been by almost universal consent divorced from the hawks, their likeness to the goatsucker tribe has been all the more commented upon. They have the same retiring shades of browns in their plumage, they fly softly like aerial Agags or moths, and they are nocturnal. All this, of course, is hardly enough to prove a close alliance. But the facts may be slight indications which will be confirmed by later studies of the birds. It is curious, too, and not unsuggestive, that in New Zealand the name " More-Pork " is applied to an owl. Our bird is naturally considered to be a bird of ill-omen on account of its really ghastly looks, and its habit of sitting upon tombstones confirms the popular view. Its near ally, the oil-bird, or guacharo, of South America, shares its ill-omened reputation, which is enhanced by a living in caves. The *Podargus* is remarkable among goatsuckers for building a nest on branches. The others lay eggs on the ground. The tribe generally does not lend itself to confinement, and it is unlikely that the visitor will meet with more than one example of the

Caprimulgidæ in the large collection of birds at the Zoo; and that will doubtless be a *Podargus*.

The Snowy Owl

It is true that visitors to the Zoological Gardens are not so much in search of British animals as of unfamiliar exotics; but the snowy owl (*Nyctea nivea*) may be fairly taken as an example of the owl tribe, though it does occasionally creep, intrude, or climb into the fold of British birds. It cannot, however, be really considered to be a British bird in the full sense of the adjective, inasmuch as it is at most a rare straggler. As its plumage really tells us, the snowy owl is a fowl of circumpolar range, though some ornithologists have differentiated an American from an European form. These birds prefer the desolate and snowy tracts of the extreme north, and "there," as Isaiah said, "shall the great owl make her nest, and lay, and hatch, and gather under her shadow." The late Dr. Stanley, in his well-known book upon birds, even went so far as to say that the snowy owl, when surprised in more temperate latitudes, as it has been on more than one occasion, hopped from snowy patch to snowy patch, and avoided the snowless intervals, where it would be more conspicuous. The bird is, in fact, one of those polar creatures, like the white bear, which appear to be coloured in relation to their normal surroundings, and in which this white colour is borne winter and summer alike. *Nyctea*, however, is not wholly white, but spotted with black. This owl is typically owl-like in its form; indeed, the group of Strigidæ is one which is sharply marked off from other birds; there is never any doubt whatever about a given bird as to whether it is or is not an owl. It is also one of the largest of owls, and dispels in its own person a common belief about owls, i.e. that they are not only nocturnal, but cannot bear to look upon

SNOWY OWL

To face p. 168]

the sun. The snowy owl, which lives, during summer at least, in a country of perpetual daylight, would fare but badly were it to be nocturnal or even crepuscular. The popular belief in the night-loving habits of owls is, of course, accurate in so far that the majority of owls do, as a matter of fact, hunt at night. But that is quite a different thing from saying that no owl can suffer the day. The names *Heliodilus*, "sun-fearer," and *Photodilus*, "light fearer," serve only to perpetuate this inaccuracy. These names are those of two Madagascar genera of owls. The snowy owl does not share in a curious defect of organization which mars many owls. The earholes, particularly large, do not show either superficially or in the underlying skull an asymmetry which is a common feature of strigine architecture. Like others of its kind, *Nyctea nivea* (or *scandiaca*; it has several names, like most birds that have been long known) is rapacious in mode of life, a characteristic which involves adequate beak and claw, and has been largely responsible for placing the owls with the hawks, eagles, and vultures, and separating them only from those birds as nocturnal Rapaces. On the other hand, the noiseless flight, the dull greys and browns of colour have led some to associate these birds with the tribe of goatsuckers; a likeness of plumage and flight which may be, after all, not so delusive as a test of affinity as some such resemblances are apt to be. All that one can say at present with even moderate certainty is that the Striges are not hawks; they are not by any means to be placed in the same division with the Accipitres. What they are exactly is left to future enquirers; at present the anatomical knowledge, and also the absence of intermediate types which show a leaning, forbids any dogmatism. The snowy owl pursues birds, and has, as have most carnivorous creatures, a distinct partiality for the wounded and therefore defenceless birds. It is

said also to fish. Though the snowy owl is no longer to be reckoned an inhabitant of Great Britain, its absence from this country of late years is probably to be looked upon as due to amelioration of climate. For the discovery of bones, or, to be accurate, a single bone, in the celebrated cavern, Kent's Hole, near Torquay, shows unmistakably that the snowy owl in former and colder periods was a genuine dweller in the south of England. In relation to the colour of this owl and its habitat, it is interesting to note that the Virginian eagle owl (*Bubo virginianus*), a bird also to be found in the Gardens), is whiter as it approaches nearer to the north.

The Kea Parrot.

New Zealand has only a few kinds of parrots to boast of, unlike the neighbouring Australia. There are not more than half a dozen species or so, but two at least of these are of extreme interest ; these two are the owl parrot or kakapo (*Strigops habroptilus*), a flightless form with the face of an owl, as its name denotes, and of peculiar structure, and the kea and its ally, the kaka, of which we shall speak here. This bird, which is known by the scientific name of *Nestor notabilis*, is of a dull olive-green hue for the most part, the feathers being tipped with black. The rump and the inside of the wing are red. It has a long bill and is a good-sized parrot altogether. It used to be classed with the Australian and Eastern lories ; but Dr. Garrod, at one time Prosector of the Zoological Society, proved that it is not akin to those brush-tongued parrots, although the tongue is slightly frayed out at the end. He thought it to be a near ally of the typical parrots represented in almost every house in this country by the familiar and African grey parrot. Others have thought that it should be raised to the dignity of a special family among the

parrots, and in that position we shall leave it without further comment. The general aspect of the bird will leave no doubt upon the mind of the visitor that he is looking at a parrot; but it will probably not occur to him that this bird is a murderous fowl, which has as it were deliberately trodden the Accipitrine path and deserted the innocent and frugivorous ways of most of the parrot tribe. Inasmuch as there are, or were, some ornithologists who regarded the parrots in general as modified hawks, this revived taste for flesh seems to have a meaning; but, on the whole, it is to be pointed out that the parrot tribe, whatever their real affinities are, are not to be placed anywhere near to the eagles, vultures, and hawks, in spite of their hooked beak and cere at the nostril. Probably they are to be looked upon as nearer to the plantain-eaters of Africa and to various allies of those. In days gone by the kea was a vegetarian, or at most an insect-eating bird. But with the colonization of New Zealand came in due course mutton, and the kea adopted the habit of loafing round sheep-killing establishments and nibbling at garbage. From this comparatively harmless taste the kea found it but a short step to murder, and nowadays a herd of keas will surround and kill a live sheep, particularly perhaps a weakly one. So successful did these raids become that the government was invoked to protect the farmer and the slaughterer. It seems to have taken some time for the kea to develop fully this noxious and carnivorous habit. For the facts of its depredations were only published for the first time in a scientific journal so lately as 1871; and the advent of specimens at the Zoo have never failed to elicit from the daily press further comments on what is indeed a genuinely remarkable fact. It is frequently remarked in such communications that the goal of the kea's bill is the kidney fat. It is true that the lumbar region is the one

generally attacked, and a well-known surgeon exhibited some years since a preparation of a sheep so treated, in which the bird had performed the operation of "colotomy," or cutting into the large intestine. But it is now certain that the kea actually prefers lean to fat, like our old friend Jack Sprat, but, unlike that gentleman, will eat both substances. One might think possibly that this change of feeding habits—which may ultimately be responsible for a change in at least the digestive organs of subsequent keas, and be thus a most excellent example of the influence of man upon faunas—having been acquired would be fixed, and that animal food would now be a necessity. This, however, is not so. Specimens at the Zoo have been fed on ordinary parrot food, and have thriven thereon and showed no symptoms of pining for unnatural mutton chops. Nevertheless, mutton chops have often been freely supplied to these birds when in the parrot house. The capacity for an entire change of diet gives the philosopher room "furiously to think," for it seems likely that many kinds of beasts in the past have disappeared from the face of nature through inability to adopt such liberal opinions, and it is a fact that omnivorous creatures, who need therefore place but little dependence upon the vagaries of Nature, are often of primitive and long existent kinds. This parrot, like others, has a voice. Sir Walter Buller asserts that it mews like a cat, and that it also utters a "whistle, a chuckle, and a suppressed scream," a round of noises which is unsurpassed in the bird tribe. This flexibility of voice (and it may be added that the kea can be instructed in the art of the usual parrot unpolite conversation) depends partly in these birds upon the complicated structure of the voice organ. That organ has several muscles pulling different ways, and thus allowing of much change in the shape of the air column, which causes the vocal chords to vibrate

and thus sound. It lives a good deal on the ground, as might be supposed from its propensities to convert sheep into mutton. And when on the ground it hops in a corvine fashion instead of adopting the more usual psittacine waddle. *Nestor meridionalis* is the only other living species, and its Maori vernacular name is

KEA PARROT.

Kaka. This *Nestor* does not appear to have as yet taken to a diet of mutton ; it feeds upon insects, and is more arboreal than its ally. Both species may be seen at the Zoo from time to time. Both also nest in crevices of rocks, and of course, as all parrots do, lay white eggs. The laying of white eggs is correlated with a concealed nest, but the correlation does not amount at all to anything like cause and effect. For eggs placed in exposed

nests are sometimes white, and coloured eggs are often secretly hidden from prying pard and other egg eaters. The New Zealand archipelago once nourished two other species of *Nestor*, both of which are now quite extinct, so far as we know, though the recent occurrence of the supposed extinct rail, *Notornis mantelli*, makes us careful in making too clear a statement on the point. It seems unlikely, however, that we shall ever see again either *Nestor productus* or *Nestor norfolcensis*.

The Koel

As a representative, and that a very typical one, of the cuckoo tribe we shall select the Oriental koel (*Eudynamis orientalis*, or *honorata* as the name apparently more correctly runs). This bird, like other cuckoos, has what is called a zygodactyle foot ; that is, the toes are arranged in twos, one pair being turned forwards and the other backwards. The " great " toe and the fourth toe are those which are turned backwards, and the result of this is an effective grasping organ, from which alone it might be safely inferred that the cuckoos are arboreal birds. And yet this generalization is marred by the fact that there are cuckoos which pass at least a great deal of their time upon the ground, such as the American Roadrunner (*Geococcyx*). That originally cuckoos were typical " insessores " seems however to be clear. The koel is at least often to be seen at the Gardens, and it is one of the few cuckoos in which the two sexes vary greatly in colour. In fact the variation in plumage from the cock to the hen is as great as in any bird. The cock bird is black and the hen brown, with white spots and bars. In our common cuckoo, *Cuculus canorus*, a careful examination shows slight, but very slight, differences of colour in the two sexes. It has a good strong curved beak and yet, unlike our cuckoo, who seems to take a delight in the most bristly

and "warningly coloured" of caterpillars, the koel is a pure vegetarian. This bird in its several species is widely ranging in the East, but belongs entirely to the eastern hemisphere. Its name is plainly onomatopoeic. Its voice is melodious, and we are informed that it is used by the youthful oriental as a comparison standard of the voice of his beloved as is its plumage of her beauty. But on the other hand it is black of heart like other cuckoos, and leaves to others the care of bringing up its offspring. This cuckoo lays its eggs for choice in the nests of the Indian crow (*Corvus splendens*), and it is remarkable that the wiliest among Indian birds does not frustrate its unbidden guest. Its eggs, too, are like those of the crow in colour, though smaller; it is said that the newly hatched cuckoo ejects its foster brethren in the good old fashion of the British cuckoo. It diverges from its ally in this country in the fact that it is not migratory, and is entirely stay-at-home. Some would write the name cuckoo "cuckow," a reversion to an older, but not in our opinion "more scholarly," method of orthography. For as the word is, like the word "koel," distinctly formed in imitation of the note of the bird itself, other old transliterations might be invoked. Thus we might insist upon calling the bird "Gukgo," and indeed that word is a trifle more suggestive of the bird when he "alters his tune" in June. There are at least two remarkable facts about the cuckoo tribe, with the outlines of which every one is acquainted, and about which it is necessary to say something. The parasitical habits have been known from the remotest antiquity. The knowledge of the same has gradually accumulated, but there are still problems that require solution. It is always mentioned as a curiosity of the history of Natural History, that the habits of the cuckoo were largely elucidated by the discoverer of vaccination, Jenner. What the cuckoo

actually does is broadly this. The eggs are produced rather continuously, so that the bird could not very well place them all in one nest and then proceed to the duties of incubation. The process would be too long for the life of the parent. Thus it has had recourse to its well-known habit. In accordance with the varied hospitality upon which the cuckoo insists, the eggs vary greatly in colour; but whether there is always a correspondence between the nest selected and the colour of the eggs laid therein is not so certain. It has been suggested that individual cuckoos acquire the habit of laying their eggs in the nests of a given species, or even for a series of seasons in the nests of the same individual. That therefore the eggs, by a process of elimination, get to be like those of the adopted foster parent, and that the variety of egg coloration in the cuckoo is a matter of individual cuckoos, and not individual eggs of the same cuckoo. It is furthermore plain that the young cuckoo is stronger and more muscular than its fellow nestlings and that it actually does forcibly eject them. But this predatory instinct on behalf of its young is not universal in the cuckoo tribe. All the immediate allies of the *Cuculus canorus* of our islands are parasitic. But *Eudynamis* is the one exception apparently among the group of cuckoos to which it belongs that shows this characteristically cuculine habit. This shows of course that the habit is but a recent one, a point of view that is supported by the rare occurrence (one case at any rate has been authenticated), of common cuckoos building a nest of their own, and attending to their own offspring The lark-footed cuckoo (*Centropus*), usually to be seen in the Zoo, is not parasitic. Now it is interesting that this cuckoo, like some others which are equally independent of the assistance of other birds, lays a white egg. The parasitic species have apparently all of them spotted and

blotched eggs, so that they are more or less like the average bird's egg.

Another matter of interest concerning cuckoos is the frequently close likeness which many of them bear to other birds of quite different groups. This "mimicry" is to be seen in our own cuckoo, whose likeness to a hawk was commented upon by Aristotle. That small birds share in the deception seems to be shown by the fact that they will "mob" a cuckoo, apparently under the impression that they are annoying their hereditary enemy. The Indian "brain fever bird" (*Hierococcyx*), is still more like a hawk, and it has deceived into a state of excitement small birds at the Zoo. The advantage of such a likeness may be held to be proved in these cases where a superficial resemblance may protect a feeble bird from assaults on the part of ravening, but timid and suspicious, fowls. There are, however, other cases somewhat different in their nature. A large Sumatran ground cuckoo (*Carpococcyx radiatus*) lately exhibited in the Insect House at the Zoo, had the swaggering strut of that "miles gloriosus" among birds, the "game bird." It may be that here the aspect of the cuckoo suggested to the hawk that under the swaggering gait lay an armature of spurs. The cuckoo to which we have already referred, viz. *Centropus*, includes a species which is named "*phasianus*," a name which suggests precisely the same kind of similarity.

Touracou

The touracous with their brilliant colours, often red and green, are common occupants of the cages at the Zoo.

These beautiful birds are African, and only African, in range. They are eminently tree-frequenting birds, and the outer toe is reversible in order that it can enable the bird to grapple with different needs as it moves from branch to branch. It is generally held that the

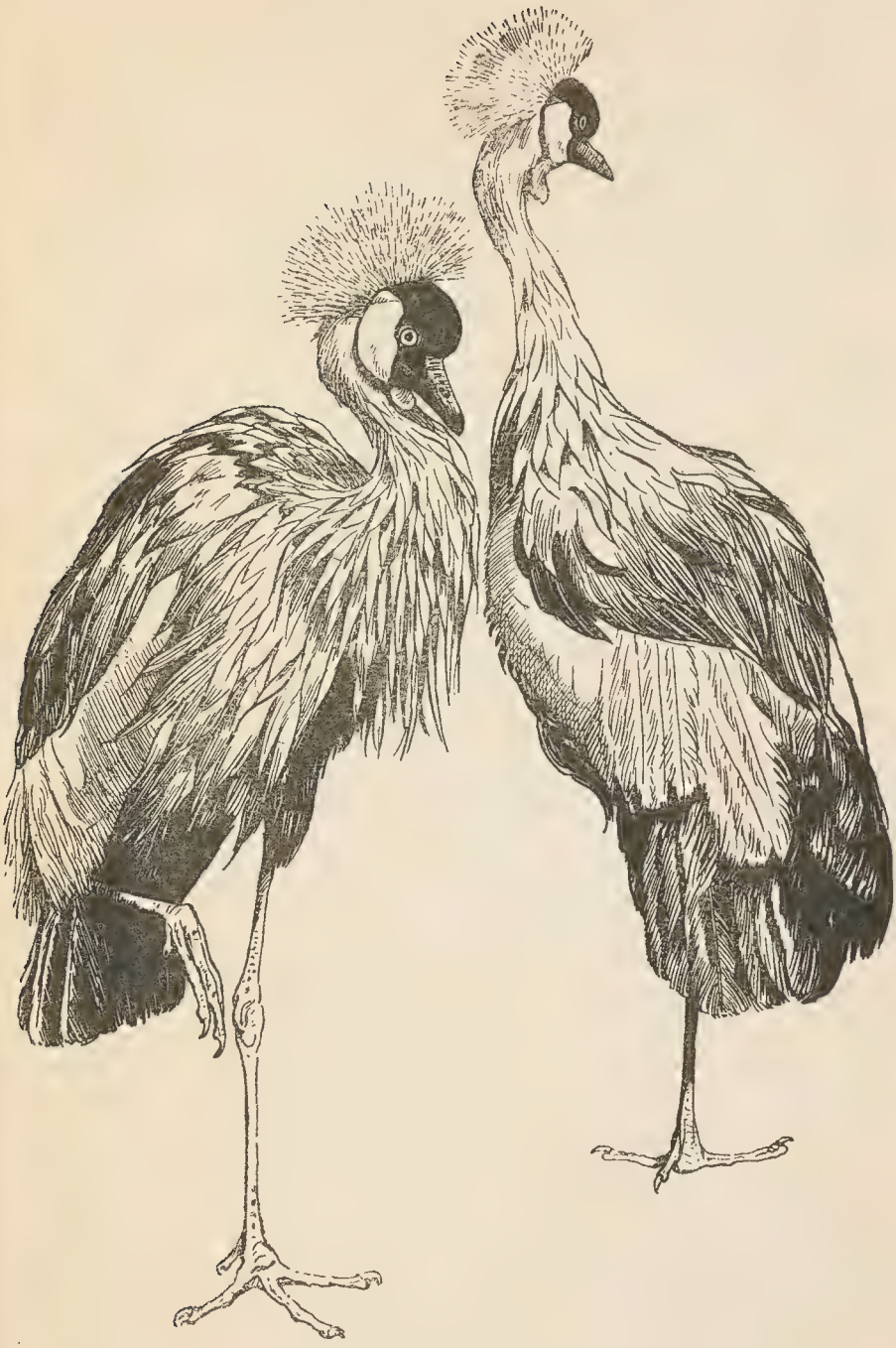
touracous come nearest to the cuckoos in systematic position. But it is clear that, after all, they are a somewhat isolated race. The principal fact of interest about them is the red colouring matter of the wing feathers. In considering the peacock, it is pointed out that colours in birds' feathers may or may not depend upon the presence in the feather of a pigment of that particular hue. In the peacock the bright metallic tints are the product of the feather structure and of a blackish pigment below. In the touracou, on the contrary, the red feathers contain a red pigment, which can be dissolved out, and which shows in solution the same fine colour that it shows when embedded in the substance of the feathers. Some characteristics of this pigment have given rise to what must be regarded as rather a legendary history. It has been noticed that in wet weather these birds confine themselves to the densest shades of their native thickets, a proceeding on their part which is not at all unusual for a bird. But a special reason for this was alleged in the case of the touracou. The red pigment was held to be dissolved out by the warm tropical rain, leaving the feather blanched. It was furthermore added, with perhaps an eye to paradox and effect, that when the bird was shot and happened to fall into water, it dyed the stream red, not with its own blood, but with the dissolved crimson pigment. The actual facts upon which these statements have been based is that the colour can be removed from the feathers by steeping them in alkalis. And furthermore that ordinary tap water, which is as a rule slightly alkaline, will be tinged to a perceptible extent after a feather has been steeped in it, particularly if the water be warm. It is, however, doubtful whether a touracou is bleached by exposure to a tropical or any downpour. The name turacin has been applied to this pigment, and it is characterized, a somewhat

rare occurrence among animal pigments, by having a spectrum with absorption bands. It furthermore contains copper. It is a highly interesting fact in view of the supposed relationships of the *Musophagidæ*, as the family is termed, to the cuckoos, that the same pigment has been found in a cuckoo.

The Golden Crowned Crane

This bird, the handsomest though not the largest of the cranes, *sensu stricto*, is one of those birds which may certainly be found in one of the outside paddocks of the Zoo. In fact, cranes generally are a strong feature in the Gardens, and nearly all the known species have been exhibited. A great many may usually be seen at any given time, and thus the visitor can note the points in which this crane differs from its allies. It has, as in cranes generally, a sharp and longish beak, though not so long as in the typical cranes of the genus *Grus ;* its legs again are long, but not so long as in the typical cranes. It has, however, what no other crane has, a tuft of golden coloured feathers, consisting merely of the stems of the feathers without their lateral branches, the barbs, upon the crown of the head, whence of course its popular name. The cranes, as a race, could only be confounded with the storks, to which their long and pointed bills ally them. But this apparent likeness, as well as the fact that both groups of birds have long legs, is not a sufficient reason for placing them near together in the face of certain profound differences. Even by external characters it is easy to draw a line between the storks and cranes. The latter have a small hind toe, and the nostrils are far forward on the beak ; in storks the hind toe is large and the nostril is at the base of the beak. Internally there are important differences, especially in the skull. In the stork tribe the bony palate is continuous across the

mouth, while in the cranes a soft interval is left in the middle line. Cranes, moreover, do not as a rule perch high up in trees or upon buildings; while both herons and storks do. Our particular crane is a native of Africa only, in which continent it is represented to-day by two species, to which the scientific names of *Balearica chrysopelargus* and *B. pavonina* are applied. *Balearica* suggests another habitat; but apparently the occurrence of either species of crane away from Africa is extremely rare. It has, however, been alleged to have been, in the eighteenth century, an inhabitant of the Balearic islands. This evidence however, when duly sifted, appears to amount to a statement by a Spanish gentleman who died in 1784, that he had heard it said that a specimen was found in those islands in the year 1780. Its rarity in Europe and Northern Africa and its occasional wanderings into these countries, coupled with its beautiful crown of gold, may perhaps be at the bottom of the phœnix stories. Tacitus tells how in the consulship of Fabius and Vitellius, "Post longum sæculorum ambitum avis phœnix in Ægyptum venit." Now so rare is the crowned crane in Egypt that the late Mr. Blyth could find no record of its occurrence in that country. Thus a rarely appearing bird, unfamiliar therefore, and with a flame-like and radiating crown of feathers, would strike an imaginative people as something odd; and out of these actual facts one hardly knows what superstructure may have been built. There is a pretty tall one if the phœnix has anything to do with this bird. Barring the eagle's beak, the crowned crane would serve as an excellent replica of the phœnix in the so-called Life Assurance Corporation's advertisement. We are, however, concerned here with a living and very real, and not with a fabulous, bird. In the skull of the crowned crane is a curious feature which is not a little deceptive. Underneath the crest the fore-



CAPE CROWNED CRANE.

head shows a pair of elevations of the bone which suggest exactly the bony horn basis in certain mammals. It seems to us very probable that if nothing were known concerning this crane save its skull-cap, it would have gone down to posterity as a horned bird. And very likely the tiny horn on the head of the horned screamer (*Palamedea cornuta*), a close ally of the screamer *Chauna*, as we note on another page, would have been quoted as the last vestige in a living bird of a former horned race. But the crane is not horned, only crested. The deep note of cranes, of intense loudness, is familiar to all visitors to the Zoo, and is especially to be heard at evening. It is aided by the long windpipe, which is coiled like a trumpet and adds of course by this increase of length to the volume of the sound produced. This special arrangement is not found in our crowned cranes, who are thus less specialized and more primitive representatives of the crane tribe than the remaining forms.

The Screamer

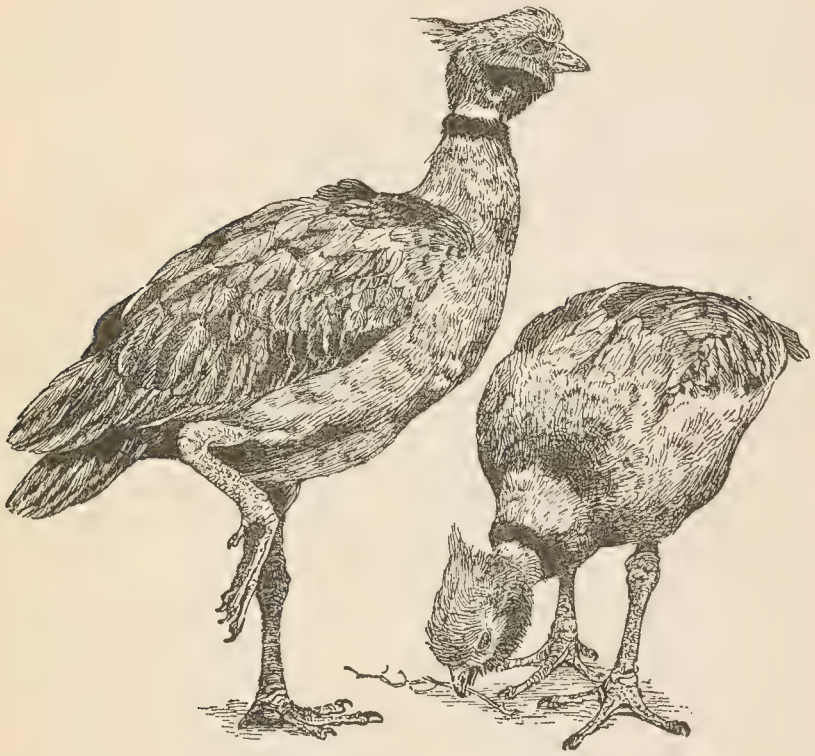
South America is the home of many waning races of birds and beasts ; in its dense forests there lurk representatives of whole groups, which once flourished abundantly upon the the land, but are now reduced to scarce waifs and strays, the flotsam and jetsam of a previous order of things. There is one living "diprotodont" marsupial, the sole remnant of the otherwise extinct family *Epanorthidæ ;* the rail-like *Heliornis* or *Podoa* forms, with two allies in Africa and the East, the sole remains of a group of birds possibly antecedent to the widely spread rails and water hens of the rest of the world ; the mysterious Guacharo or oil-bird is of a type peculiar to itself at present, and the "Four-footed" bird of the northern parts of the South American continent (*Opisthocomus cristatus*) has not a single close ally living anywhere else. Among this wreckage are to be

placed the birds known as Screamers or Kamichis, known to us by three species, usually referred to two distinct genera, viz. *Chauna* and *Palamedea*. The Derbian or the crested screamer (*Chauna derbiana* and *C. cristata*) is a bird which looks like nothing else in the bird way. It has the head of a fowl attached to the body of a good-sized goose, the whole surmounted upon longish legs with straddling toes. The long legs suggest wading, and the large " feet " with divaricated toes safe progression upon treacherous and marshy soil. The bird is in fact at least partly aquatic ; and the likeness to a goose is not wholly a matter of outward appearance. But it cannot be definitely placed in that large order, which includes the geese, swans and ducks ; rather is it to be looked upon as the vestige of a group which perhaps produced, as a mere side issue, the anatiform birds. The main stem with its archaic characters has come down to us in these three desolate birds which form the subject of the present article.

The chaunas have a puffed out and even gouty appearance about the legs. Coupled with a slowish gait this suggests overfeeding, a complaint which is not unknown at the Zoo through the unnecessary kindness of visitors. It is, however, merely a conspicuous expression of a state of affairs which characterizes birds in general and not the screamers only. These birds, like others, are literally " puffed out with wind and the rank mist they draw " in order to lighten their sometimes cumbrous bodies. The lungs of birds are not simply bags more or less subdivided into multitudinous chambers as in ourselves and other animals ; but they communicate with a complex system of ramifying air cavities spread through the body and permeating even their very bones. There is hardly a portion of the bird's body which is free from air-containing spaces, a state of affairs which obviously aids it in spurning the

dull earth. But curiously enough, in view of the fact that in nature the coat seems to be invariably cut according to the cloth, the amount of aeration is not precisely correspondent with the capacity for flight. So thoroughly is the body of the screamer lightened in this way that when the skin is pressed it absolutely crackles with exploding bubbles. The chauna, however, though largely a ground bird, can fly and soar to a great height. Mr. W. H. Hudson described it as circling upwards like the lark and uttering continuously its melodious sounds from the topmost air. The visitor will perhaps hardly agree with the author of that delightful and instructive work, *The Naturalist in la Plata* in considering the screams of the chauna as tuneful ; but Mr. Hudson asserts that in captivity the original melody is lost ; and in any case a distance and rarefied air may produce a softening of the ear-piercing-shrieks of the captive bird more reminiscent of the lark than one is disposed to admit after a visit to the Zoo. For when a pair of these birds, aided by the friendly rivalry of the cariama, the other screamer, really lay themselves out for a prolonged conversation, the noise is almost insupportable. Far out in the wilds of Regent's Park this awful din can be heard, farther away than any of the multitudinous sounds inherent in the menagerie. The *Palamedea* differs in a number of points from *Chauna*. The most striking unlikeness is in its possession of a single and small horn upon the forehead. It cannot be very serviceable either for defensive or offensive purposes, on account of its weakness and flexibility. Besides, if *Palamedea*, or for that matter *Chauna* too, feel any desire for aggression, and they often do, each wing has a hard and exceedingly serviceable horny outgrowth with which a formidable wound can be inflicted. These latter spurs are found in some other birds, for instance in the appropriately named "Spur-winged Goose."

The horn on the head must therefore be either a sexual adornment or a relic from the past. In the latter case it may perhaps be looked upon as an inheritance from those long since defunct and bird-like reptiles, the Dinosaurs ; and like an armorial bearing of a military kind, be rather a mark of aristocracy than an indication of a pugnacious and offensive character. We have



SCREAMER.

intimated that the screamers are of ancient lineage. That conclusion is accepted on account of the fact that they cannot be definitely referred to any existing group of birds, coupled with certain traces of reptilian conditions in their organization. The most noteworthy of these is the character of the ribs, which have not, as have all other existing birds without exception, certain

little hook-like processes upon them, which serve for the firm anchoring of certain muscles. These "uncinate" processes, as anatomists term them, are also wanting in that undoubtedly archaic and "mediæval" bird, *Archæopteryx*. Another ancient character has been shown by the secretary of the Zoological Society, Dr. Mitchell, who has justly likened the coils of the intestine to those of a crocodile. It is an odd thing, as showing how those who interpret extinct animals may fall into unwitting error, to note that the median horn of *Palamedea* leaves no traces of its presence upon the skull; whereas the skull of an entirely hornless bird, the Cape crowned crane (*Balearica*), which we have described on another page, has a bony excrescence or rather a pair of them on the skull; this would lead the naturalist, were he only acquainted with the skull, to gratuitously present to the Cape crowned crane a pair of rather large horns, and to descant with apparently well justified inference upon a descendant of horned Dinosaurs. As we see, the precise reverse of the indications offered by the skull exist. The *Palamedea* is horned, while *Balearica* is not.

These clamorous inhabitants of the Zoo are, as a rule, to be found in the well filled Eastern Aviary. But in the summer months they are sometimes moved for a change farther west into open paddocks suitable in size for walking exercise. In such a situation and in the year 1904 the *Chauna* bred and reared three young. This event happened for the first time in the history of the Society, though many pairs have been exhibited.

The Condor

The condor, together with the king vulture, the "turkey buzzard," and the Californian vulture, form an assemblage of birds which are collectively known by the general term of "the American vultures,"

which only explains that they are inhabitants of America and that they are vultures. A deft name introduced by the late Mr. Seebohm, viz. *Mimogypes*, emphasizes the now widely received view, that these birds are not near allies of the vultures proper, i.e. those of the Old World, but that they are vulturine in habit though belonging to quite a different group of birds. No one looking at the great condor of the Andes would come to any other conclusion than that it is a vulture ; and yet even externally, it may be distinguished from its carrion-loving allies of Europe, Asia, and Africa. The feet in the first place are decidedly feebler than those of vultures, strictly speaking. The bill is less developed, and it would be noticed after a short time that the condor has no scream, or indeed voice of any kind, to raise the echoes such as is possessed by the birds of prey of this side of the Atlantic Ocean. It can, in fact, only hiss. The reason for this is quite the same kind of reason as that which forbids to the true storks the capacity for uttering their sentiments. The bird has not a " syrinx, " as the avian voice organ is termed. The windpipe or trachea passes without change of character into the two tubes, the bronchi, which supply with air the two lungs. No modification of the cartilaginous rings at the bifurcation, no muscles for altering the approximation of these rings, are there to aid in the production of a definite voice, even if only one capable of expressing itself in a scream, which is the hawk-like mode of expression. The condor, too, and its immediate allies, do not possess what so many birds do possess, i.e. two blind tubes, the cæca, arising from the intestine. In the hawks, eagles and vultures of the Old World these cæca are always present, though very tiny ; in *Sarcorhamphus* even the very vestiges have gone. There is no trace of the blind appendages. Other anatomical features which differentiate these birds need not be gone

into ; but they exist, and are of importance. Anatomy forbids us to place the American vultures quite close to the accipitrine scavengers of the Old World.

The condor with its black plumage, except on the wings where it is grey, and the tips of the big wing feathers which are white, the white ruff like a lady's feather boa round its neck, its naked throat and the wattle which rises on the head of the cock bird, is one of the largest of flying fowls : it has an expanse of wing which is hardly surpassed in the " aery caravan." A specimen in the Zoo had a stretch of wing of 7 feet 6 inches, and the bird is said to reach so great a span as 9 feet. But even then it is equalled by the Marabou stork, which expands its wings to precisely the same length, at any rate so far as concerned a large individual at the Zoo. The condor, which measured seven feet and a half, had a body weight of 131 lb. 9 oz. But a relationship between weight and expanse of wing is not by any means always accurate in the bird tribe. A lammergeier, for example, of 10 lb. in weight had a wing expanse of 8 feet 8 inches. Nevertheless, there is no doubt about the fact that the condor is a powerful flyer, and its soaring capacity is a matter of universal knowledge. It is precisely " every schoolboy " who does know this fact, for the condor figures largely in tales of adventure. That it will attack persons, or at least threaten to do so, seems to be a fact. When thus attacking it has the cunning to take advantage of sunlight, and only to attack in brilliant weather, when it can swoop down with its back to the sun, whose rays dazzle the swooped-upon one. It delights in the fastnesses of the Andes of Peru, and prefers to live at an altitude of from 9 to 16,000 feet. The " scenting " of prey by this and other vultures is a matter of common notoriety ; but the causes of such keenness are not thoroughly agreed upon. It seems to be useless to attribute the

instinct of the bird for offal to the sense of scent. The brain of the bird shows that it can have but little power of smell. For the olfactory lobes, those regions of the

CONDOR.

brain which are largely developed in keen-scented creatures, are exceedingly inconspicuous. The real explanation appears to be vision. A condor hard by the corpse detects it with ease while circling in the air

above. A condor a trifle farther off observes the interest shown by its companion, and so on to the uttermost verges of Peru. The condor is sure to be on view at the Zoo, it is so very excellent a bird for menagerie purposes—a statement which would appear to be unlikely if there were no facts to support it. But they live long, and in the year 1889 died an old bird which was purchased so long ago as 1856. The very first specimen ever acquired was bought in 1853. Besides the common condor known as *Sarcorhamphus gryphus*, is another form, the "condor pardo," which is through life of a brown colour, a hue which belongs to the young of the common species.

The Secretary Bird

This handsome long-legged hawk is practically always on view at the Zoo. Its grey body with black wings, its stilt-like legs, and the tuft of feathers on the head which have suggested the name, mark it out as an abnormal form of the Falconid tribe. Its deeper lying structures show it to be not very far removed from the eagle tribe, but still to form a very distinct group of its own, which is thought by some to be nearer to the root of the rapacious birds than any existing form. The bird is purely African, and ranges from north to south. On the west it has been given a different name. Its range in that continent is not at all unlike that of the crowned crane. The name of secretary bird is thought by some to have been derived from the tuft of feathers on the head, which suggest a bunch of pens carried by a clerk. Others again have held they are like arrows, and that the name is a corruption of *Sagittarius*. *Serpentarius reptilivorus* is its scientific appellation. The bird is one to be fostered, and it is indeed on the protected list; for it attacks and gets the better of the numerous venomous serpents of Africa. Its mode of

fighting is to use one wing as a defence, and to buffet with the other, until the puff adder or cobra is wearied of the strife, when it is swallowed. Sometimes, though rarely, the serpent is the victor, and it is said that if the snake bites a feather the secretary bird will immediately pull it out. Considering the points of likeness which the secretary bird does bear to the crane tribe, from which, according to the opinion of at least two bird anatomists, it is perhaps to be derived, it is significant that its voice "precisely resembles the call of the Stanley crane." Its feet and beak, however, proclaim it a hawk. So too, its eggs, which are white blotched with red; but then eggs are not so decisive as marks of affinity, and crane's eggs are after all not so very dissimilar. The energy of the secretary bird in pursuing reptiles is attested to by the traveller le Vaillant, who withdrew from the stomach of one of these birds twenty-one small tortoises up to two inches in length, eleven lizards of seven to eight inches, three serpents as long as the arm, and a multitude of grasshoppers. In confinement it is apt to take toll of the fowl run; but in a state of nature it does not seem to care for birds. The bird builds a huge nest which is used year after year, and is even added to. Therein are deposited two eggs. The secretary bird establishes spheres of influence, like the robin over here. It is apt, like mankind, to be much occupied with boundary questions, and will not tolerate aggression.

The Osprey

The osprey treated of here has of course nothing whatever to do with the plumes of feathers known to the "trade" by that name. The latter are the spray-like crests of the white egret, one of the herons. The osprey of this book is a hawk which gets its livelihood in a way which is rare among rapacious birds, that is by fishing. Its name is believed to be a corruption of *Ossifraga*, i.e.

bone-breaker, a name which is now applied to certain petrels. The origin of the name from its destructive qualities is quite analogous, as has been pointed out, to the connexion between the words hawk and havoc, and between raven and ravine. The osprey is a fish-eater, but it catches its fish as a hawk does, and not as a kingfisher does, for example ; it strikes the fish in fact with its talons as if it were a partridge. The older type of ornithological handbook used invariably to begin with the Accipitres, as if taking to heart Chaucer's recommendation—

> The fowles of ravine
> Were highest set and than the fowles smale,

and continued with the Passerine birds. There is no reason for placing the osprey and its kindred either at the head or at the base of the avian series, as might be implied by such a placing. But what their precise place in the system should be is a matter for inquiry rather than for *ex cathedra* statement. That they are rather perfected birds in their way is shown by the complete closure of the roof of the mouth. All birds seem to start life with the maxillopalatine bones, as they are termed, in non-juxtaposition, which leaves a gap in the bony mouth of the roof. This condition is persisted in in the Limicoline and many other birds ; but in a great variety, which are not necessarily nearly akin thereby, the bones have grown inwards and met to form what Prof. Huxley called a desmognathous palate. And the hawks, as well as such obviously dissimilar birds as the hornbills and the toucans, are of this number. The hawk tribe, which embraces a vast number of forms, such as the vultures of the Old World, the eagles, the falcons an hawks, the kites, and the caracaras of America, has not merely this character ; but they all agree in the powerful talons, with strong legs to match the strong and hooked bill, the cruel flat head upon which

Michelet descants in *L'Oiseau*, the fact that the gape of the mouth reaches, but does not pass, the eye, and the slight webbing between the outer front toes. The osprey has not the latter character, which, as well as a few others, produces a certain likeness to the owl tribe, which are known to be not nearly related to the hawk tribe. On account of these few facts, *Pandion haliaetus*, the osprey, has been given a separate place in the Accipitrine phalanx, which however it hardly deserves. A glance at the living bird, which is frequently to be found at the Zoo, will show this. It is unmistakably and thoroughly a hawk. The long-legged caracaras, and still more perhaps the less known *Polyboroides* of Africa, have a suggestion of the secretary bird, which is unquestionably an " aberrant " hawk. They may remind the visitor, too, of quite a distinct form, the cariama, which ornithologists now hold to be not far off from the cranes, by their habit of throwing back the neck when uttering their prolonged cry. But the remaining assemblage can only with difficulty be split up into " families," and even the carrion-loving ways of the vulture are successfully imitated by that " noble " bird the golden eagle, who will stoop readily from sailing with supreme dominion through the azure deep of air to settle upon a festering sheep's carcass. The osprey seems to be free from this ghoulish taste. This fish hawk, as it is often called, is world wide in range ; it extends much farther than from China to Peru, viz. from Japan to Brazil, and from Alaska to New Zealand. It catches fish in the sea or in lakes ; with us it is a rarity, though it has been ascertained to breed here, or rather in Scotland. And very rightly, as evidence of the proper importance to be attached to the matter, the Zoological Society awarded some years back a medal to certain gentlemen who had been instrumental in cherishing the nests and home of the osprey.

CHAPTER VII

The Painted Snipe

THIS gaily coloured Indian and African bird will serve as an instance of a not very common phenomenon among birds, that is the predominance of the female over the male sex. As a rule it is the male who is gorgeous or gaudy; he is the ornamental part of the household, and ruffles it abroad with his fellows, while the dowdily plumed hen stays at home and attends to her domestic cares. The painted snipe, however, belongs to a matriarchal species, where it is the female who is predominant in size and colouring, the cock bird, it is said, attending to the duties of incubation. A curious structural character emphasizes this reversed relation of the sexes. In many birds belonging to quite different groups the windpipe, instead of passing straight down to its entrance into the lungs, deviates into the substance of the breastbone, or under the skin, and there becomes variously coiled, the anatomical fact being followed by a more strident voice. Where the sexes differ in this it is the rule for the female to have a straight trachea without convolutions. Now in *Rhynchæa capensis*, as the painted snipe is known to ornithologists, it is the female who has a slightly coiled trachea, while that of the male is perfectly uncoiled. The term snipe is a misnomer when applied to this fowl, although it undoubtedly does belong to that great group of wading

birds, the Limicolæ, which embraces the true snipes. The Indian sportsman knows that it neither behaves nor tastes like a snipe. The anatomist tells precisely the same tale. It is perhaps rather to the jaçanas, those extraordinary long-toed birds, which walk upon the leaves of aquatic plants both in the Old World and the New, that the *Rhynchæa* approaches most nearly in structure. It has too, according to Mr. F. Finn, a skulking and furtive gait like that of a rail. The first, and so far the only, specimens brought to the Zoo were sent over by the same gentleman in 1902. The bird is unmistakably of the Limicoline order. It has the long bill of the majority of that tribe. Its colours are striking and yet are held to be "protective"; the back is olive green with yellow stripes. The behaviour of this bird has been carefully studied by Mr. Finn. During courtship they spread their wings and crouch down, something after the fashion of the ruff; they utter coincidentally a sound "like that produced by plunging a hot iron into water." The same attitudes and actions are, however, produced by dismay, and are thought to be alarming to enemies. At any rate, Mr. Finn saw a golden plover which seemed to be frightened by this display.

The Glaucous Gull

In many respects this is one of the finest of the gull tribe. It is at least one of the largest. As a rule a specimen may be seen in the enclosure devoted to the gulls at the Zoo. The glaucous gull is not strictly a British species; it is like many forms which inhabit the northern regions, circumpolar in habitat. Its occasional inclusion in the fauna of this country is due to infrequent visitations to these islands. The only equal of the glaucous gull in size is the great black-backed gull (*Larus marinus*), which is also a bird to be

frequently seen at the Zoo. The glaucous gull has a paler plumage. The gulls are a group of birds found more or less everywhere, and are of a fairly uniform coloration. The prevalent hues are grey, black and white, mingled in a way that everybody must have noted; a good many varieties of gull, comprising the more common forms, are always on view in their own special pond, and also in other enclosures at the Zoo. An exceptionally coloured gull is the beautiful ivory gull (*Pagophila eburnea*), which is brilliant white with black legs. It is an occasional visitant to our shores, and, though not willingly, to our Zoo. The greys and whites of the gulls is believed to assist in rendering the bird obscure on account of a harmony with frothing waves, over the tops of which the gull skims, or on the tops of which it rides. This may be so; but the young gull has a different plumage, which lasts for a long time, and is of a speckled brown. What is sauce for the goose ought to be sauce for the gosling; if the old bird needs this protection of invisibility, it might be thought that the young needed it more, or at least as much. But the colour of the young gull is not without significance if we bear in mind those close allies of the gulls, the skuas. Of these birds also examples are fairly certain to be visible in one or other of the enclosures devoted to birds. The prevailing hue of the skuas is brown. It is from these birds rather than from the gulls perhaps that the slang term "gull" is derived. For the skuas, though powerful enough and agile enough to do their fishing and food collecting generally for themselves, prefer to worry and harass some other fishing bird, until they make it drop its recently captured prey in sheer nervousness or fright. The older ornithologists, unduly impressed by webbed feet, put the gull near to the ducks and other aquatic birds. They have, however, nothing in common structurally except these webbed toes.

Curious though it may appear, when mere outward look is considered, the gulls come nearest to the Limicolæ than to all other existing groups of birds. The Limicolæ is that extensive assemblage of birds which includes the snipes, plovers, and their manifold kindred. One rather singular type of Limicoline (not infrequently to be seen at the Zoo) is an antarctic bird of white plumage, known as *Chionis*, or in English as sheath-bill. It is an almost ideally intermediate form. It has the aspect and marine habits of a gull ; but in some other particulars agrees more closely with the land representatives of this group Limicolæ. Another bird, British this time, offers a second bridge to connect the gulls with the plovers and the rest. The phalaropes are apt to be quite gull-coloured in their winter plumage ; a delicate grey upon the back being contrasted with a white under-surface. But the phalaropes have not properly webbed feet like the gulls. The feet are in fact lobate, with expansions of skin at intervals as in the coot. The noises of gulls are varied and cheerful. The "countless laughter of the sea" is due to the hilarious jocularity of many gulls ; one species has been named *Larus cachinnaus*, the laughing gull.

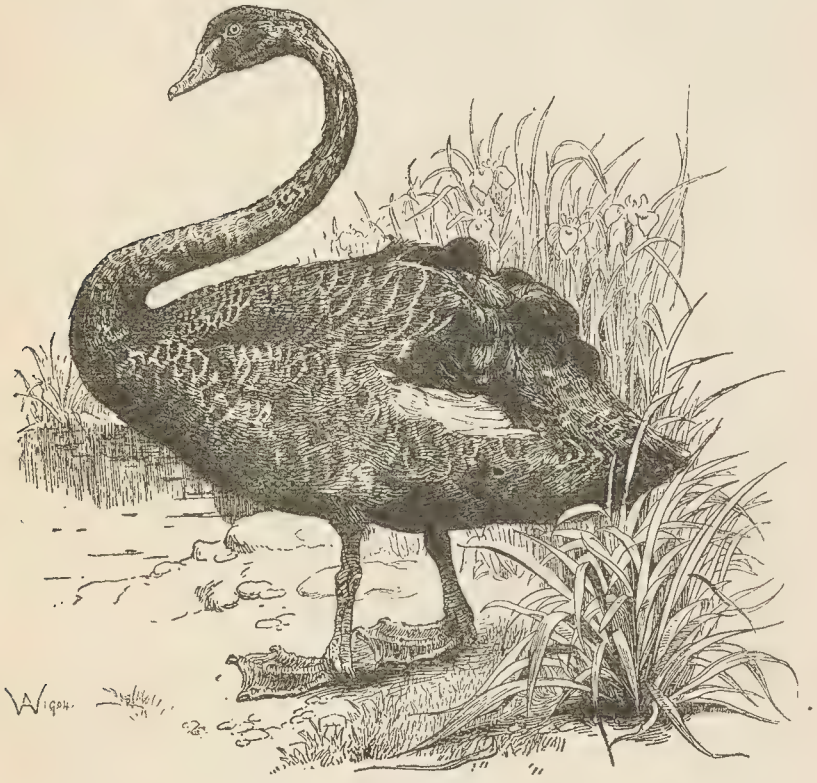
The Black Swan

It seems to be almost impossible to mention the black swan without quoting Virgil's "rara avis in terris," etc. At any rate, no writer of natural histories has ever avoided this obvious opportunity. There is, however, a kind of appropriateness in finding in Australia a negation of this kind, a sort of topsy-turvydom in colour which hangs together with mammals that lay eggs, with kingfishers that do not fish in streams but upon the dry land, and for reptiles, with weird-looking creatures that are apparently rabbits and wolves, but are really neither. The

black swan, in any case, is a precise contrast to swans in general. All the European forms, and those of North America, about seven species in all, are white. On the other hand, *Cygnus atratus* of Australia is approached, through *longo intervallo*, by the black-necked swan of South America (*Cygnus nigricollis*), which is white with the exception of its black neck. The real black swan is not altogether black. Animals that are either white or black are seldom perfectly so. Few are so black as popular works and general opinion paint them, even inhabitants of more torrid climes than Australia. About the wings are a few white feathers ; and the rich crimson skin about the beak and face is well known. It is noteworthy that this redness of visage accompanies the darkening of the general hues. The white swans of the Old World have for the most part yellow patches of naked skin about the face. With the blackening of the feathers is a concomitant darkening of this yellow into red. That there is nothing really remarkable about the black swan of Australia except its blackness, is shown by the fact that its cygnets are exactly of the usual ugly duckling coloration, a dingy grey. This bird is also in every other respect a true swan. A swan is a little difficult to define. The swans, ducks, and geese form a highly natural assemblage of birds which hardly need characterization, so plainly can they be identified as such by the veriest tyro. Furthermore, every one knows for all practical purposes which are swans and which are ducks, though to tell geese, not from swans, indeed, but from ducks, is not so easy a task. But when we come to write down in cold and logical black and white the distinctions between a swan and a duck, there is really little besides length of neck which can be used. If it were not so grave an anachronism, one might suppose that the poetical remembrance of the song of the dying swan might have come from this Australian bird, which

has, as a matter of fact, a finer and more melodious voice than many of its kindred in Europe.

The voice of the black swan ought to be more often heard in the land. It has been acclimatized here for



BLACK SWAN.

years. In the very first list of animals recorded by the Zoological Society as having been acquired, issued in the year 1831, this bird figures. Since that date it has always been in stock, and has bred in most years. Sir Robert Heron pointed out to the Zoological Society in 1833 that individuals kept by him sometimes even bred twice a year, and that, if only once, January was their favourite month, which corresponds, of course, to mid-summer in Australia. At present the months of breeding at the Zoo are various. The bird is, moreover, not so

particular as are some birds. A late President of the Society, the Earl of Derby, recorded that in 1843 a black swan bred with a common European swan, and produced parti-coloured offspring. Finally, its advantages as an addition to our ornamental water-fowl is not lessened by its comparative longevity. It has been stated to live in captivity for no less than fifteen years, *plus* a considerable number of months. There is not the least doubt that the reader of these lines will find himself able to examine more than one black swan in the Society's Gardens at any time.

Flamingoes

Although no one would be likely to confuse the flamingo with any other bird, it may be just as well to set down definitely the various features by which it is to be separated from birds in general. Its neck is long and the legs are long. The bill has lamellated edges as in ducks, but the lower half of the bill is heavier than the upper part, and the whole bill is bent in the middle at right angles. The three front toes are webbed ; the big toe is quite small and useless as a toe. As to whether the flamingo is a long-legged duck or a duck-billed stork opinions differ. Professor Huxley called its group by the non-compromising name of *Amphimorphæ*, implying a midway position, in which safe mediocrity we shall leave it. It seems to be clear that when an animal gets long legs it has also to have a long neck, or else—like the elephant—a trunk : for otherwise it cannot reach the ground. This seems almost an unnecessary pair of changes, the resultant being merely a doubling, as it were, of the original condition. It is almost like speaking of one half as two-fourths. The length of neck in birds, it may be remarked, is not, like that of mammals, accomplished without increase of the neck vertebræ. The flamingo has more neck vertebræ than a sparrow.

FLAMINGOES

To face p. 200]

As might naturally be supposed, these long legs imply a marsh haunting existence, and the bill is formed for dabbling in the mud and fishing out nutritious particles. In captivity the flamingoes are a very argumentative race, continually " cawing " at each other, and bestowing mild pecks as the argument waxes warm. The strange form of the bird has given rise to legend : it has been asserted that the flamingo straddles over its high nest of mud ; but in reality it sits down to incubate like any other bird. The flamingo that is met with in Europe lacks the almost universal red of the American *Phœnicopterus ruber*. It is noteworthy that the spoonbill of America is also much redder than its European ally. All these very red birds fade in captivity. Possibly the diminution of brilliancy is due to the impossibility of providing them with the exact food to which they are accustomed in nature. This red colour is, of course, the source of the name of the bird, which, by the way, it would be far better to call by the English name of flammant than by the Portuguese name flamingo.

The Shoe-Bill (*Balæniceps rex*)

This great bird, found along the Nile, and lately shown by Sir Harry Johnston to frequent also the shores of Victoria Nyanza, will very likely be on view in the Zoo by the time that these notes reach the reader. It has been once exhibited ; but that was so long ago as 1860, when a pair were brought over by Mr. Consul Petherick. Their remains now grace the collection of animals at the Museum of the Royal College of Surgeons. The shoe-bill is named on account of the shape of its great beak, and partly in translation of its Arabic name, which is Abu-Markhub, or father of a slipper. Others have called it the whale-headed stork ; but " stork " begs the question of its likenesses and unlikenesses, of which we shall have something to say here. The bird stands

five feet high; it has "a gaunt grey figure," with curly tufts of feathers on its head; it is characterized by "the scowling expression of its eyes," and by the bill to which we have referred. Captain Flower observed that it was like a heron in its motionless attitude, its solitariness, and in that when flying it suggested very much the large Goliath heron (*Ardea goliath*). *Balæniceps* frequents morasses, and spears fishes and water serpents. It does not seem to possess much in the way of a voice, but snaps its bill as do storks. It nests either on the ground or on low bushes near its haunts. Sir Harry Johnston, after allowing one or two specimens to be procured for the British Museum, at once put the bird on the Protected List; so that this extraordinary creature, doubtless a relic of the past, has a future before it. When it was first described so long ago as 1851, by the late John Gould, the historian of the Birds of Australia, it was recorded by him as a variety of the pelican type, probably on account of its bill. But this bill is really very like that of the South American *Cancroma*, or boat-bill (of which specimens are generally to be seen at the Zoo), a most undoubted heron. There is, in fact, not the shadow of a doubt that it is either a heron or a stork; but the question is, which? The same uncertainty of characters attaches to this bird as to *Scopus*, dealt with on another page. The late Mr. A. D. Bartlett, that excellent observer of birds, and superintendent of the Society's Gardens, discovered a very significant fact about the *Balæniceps*, which seemed at the time to settle its place in the bird world. He found that it does not possess those tufts of curious feathers which are bunched in masses, and from which a powder is continually given off owing to the constant breaking off of their tips, the "powder down patches" as they are termed. These modified feathers occur among many groups of birds, especially the herons, where it has been

suggested that they are phosphorescent and lure the little fishes to their destruction at the beak of the heron.

SHOE-BILL.

In the absence of these characteristic powder downs, the *Balæniceps* clearly approaches the storks. In one rather decisive point, therefore, *Balæniceps* is not a heron but a

stork. In another decisive point it is distinctly a heron. Its "syrinx," the voice organ situated at the junction of the two bronchi, to form the trachea or windpipe, is heron-like in form, but it lacks the pair of muscles which those birds have. Nevertheless, the muscle is represented by a vestige, a small ligamentous band, which seems to show that in this feature, at any rate, the *Balæniceps* is a heron on the down grade. Other points taken collectively seem to argue that this bird is the type of a quite separate family, showing likenesses to both storks and herons. And there we must leave it until more is known about its anatomy.

The Tufted Umbre

The tufted umbre (*Scopus umbretta*) belongs to that group of birds which we may accurately term—plagiarising from, and misquoting a trifle, Mr. Rudyard Kipling—"Storkie & Co." It is in fact one of the Ciconiiformes, as naturalists sometimes term this group. The group contains not only our umbrette, but also all the storks and herons and bitterns, and that slightly aberrant bird, the great "Whale head," or *Balæniceps*, of Africa. *Scopus* is a bird which is usually to be found at the Zoo, and, when there, in the Eastern Aviary. It is about the size of a raven and of a brown colour. It has the long and strong bill of its allies, and a rather crested head. Like herons in particular, the tufted umbre has a melancholy demeanour; it is addicted to watching patiently with downcast head and eyes for fishes, appearing as if brooding with sad reflection, as Michelet has put it, over the past glories of its family. This gloomy demeanour is at times relaxed, and *Scopus* indulges in a wild and fantastic dance with outspread wings, reminiscent of that of the cranes, who may be frequently, especially towards evening, observed to skip in similar dances at the Zoo. The bird is African

and extends to Madagascar. It has the reputation of being a bird of evil omen. In Africa it is held to be sacred and to possess the power of witchcraft. There is indeed something portentous and solemn about the behaviour of all these herons and bitterns, which easily accounts for the origin of such legends. *Scopus* is mainly crepuscular in habit, and is known to utter a croaking cry, which is significant, as will be seen presently, of its place in the ornithological temple. It feeds upon fish, frogs, lizards, and insects, and appears to enjoy an æsthetic sense not possessed by its immediate allies, but paralleled in other groups of birds—excelled, of course, in the well-known bower birds. It adorns its nest in fact with buttons, fragments of pottery, bits of glass, and any other bright-looking objects which happen to come in its way. The nest itself is eminently worthy of note. It is huge in size, and complicated in design. Instead of being content with one compartment alone, in which all the offices of nest life are performed, *Scopus* requires no less than three separate chambers, all included in the vast dome situated upon the fork of a tree which it inhabits. This is an unheard-of luxury in the bird world, especially as the umbre does not take in any lodgers, such as cuckoos. It is only recently that this bird has been acquired by the Zoological Society. The first specimen was exhibited in 1880. To most persons the outward appearance of *Scopus* suggests a stork. And it is a fact that in a large number of points *Scopus* is decidedly stork-like. On the whole its skeleton recalls those birds. But in other features of its anatomy the bird is as distinctly inclined to the heron build, and, in short, it is a perfect instance of a bird which is intermediate between two distinct families; and this is one, and that not a bad reason, for putting together the storks and herons, as is usually, but not always, done by ornithologists. If

they are not put together, where is poor *Scopus* to go? It is neither one nor the other with sufficient definiteness to please the exigeant systematist who wants cut-and-driedness. Mention has been made of the voice of the umbre. The voice is not melodious; but the chief thing is that it *is* a voice. Now, the true storks are voiceless, though they make a most efficient din by clattering their bills. Yet this is no more a voice than the chattering and gibbering of a ghost. To produce a voice, a voice organ must exist; and *Scopus* has one as good as that of any screaming or even some singing birds. Storks, on the other hand, only show in rare cases, such as the African *Abdimia*, an approach to a proper voice organ. As a rule, the windpipe divides into its two bronchi without modifying itself to form that assemblage of rods of cartilage movable by a pair of muscles which constitutes the organ of song or speech in birds. Then, again, *Scopus* does not possess that curious muscle, so useful in perching, because it flexes certain tendons of the foot, which is nearly universally found in storks and more universally absent in herons and bitterns.

Sand Grouse

There are a good many species of sand grouse; but one, viz. *Syrrhaptes arenarius*, is the most interesting to us, inasmuch as it is that bird which at times migrates in countless hordes from its Asiatic home and invades Europe even to the confines of the West. The name sand grouse is derived in the first place from its predilection for sandy spots, and in the second from the fact that it was originally confused with the grouse mainly on account of the feathered feet. The colour betrays the desert-loving ways of the bird; it is dull yellow, mottled and speckled with darker shades. The general look of the bird is dove-like, but the flight has

been compared rather with that of the plover. The anatomy of the bird, according to Professor Huxley, is almost exactly intermediate between that of pigeons and that of the gallinaceous birds, such as grouse. The name sand grouse might therefore, according to that anatomist, profitably be altered to "pigeon grouse," a name which would stamp upon the memory the characteristics of the bird. This view, however, like most other views in ornithology, has undergone some alteration; and Dr. Mitchell, the Secretary of the Zoological Society, rather considers the sand grouse to be nearer to the doves, and both of them to be allied to the plovers. Be this as it may, the main fact about the bird of universal interest is the migratory instinct already referred to. The knowledge of this only dates from the year 1848, when a single example was met with in Russia. "In 1888," remarks Professor Alfred Newton in his *Dictionary of Birds*, "occurred an irruption in quite incalculable numbers." Even Parliament was moved to pass an Act for the protection of these immigrating strangers; but, characteristically, the Act did not come into force until 1889, when the colonisers had already dwindled. In this country the birds breed, though not freely; and it was found, as had been noted previously, that the young were hatched from the egg in down plumage, and were not little naked "pipers" like the young of the pigeon tribe. These chicks arise from eggs which are laid in shallow holes in the ground, and are coloured. In this the sand grouse evidently shows characters like those of the plover tribe rather than the pigeons, which lay white eggs in nests made upon trees.

The Peacock

The peacock, the *Miles gloriosus*, or swaggering soldier of the ornithological world, belongs to the pheasant tribe, and, like them, shows a great difference in the

plumage of the two sexes; the gorgeously clad male contrasts with the dowdily hued female; and with this difference we regret to have to associate polygamy. A polygamist has to be a good fighter, so accordingly we find that the peacock, like his immediate relatives the pheasant and the barn-door fowl, is armed with trenchant spurs upon the legs. The peacock being a swaggerer, and a handsome swaggerer, has achieved for himself a place in the bird world which is rather above his deserts. The author of *The Thistle and the Rose* represents dame Nature as ordering the eagle, crowned by her king of fowls, to be—

> "Als just to awppis and owlis,
> As unto Pacokkis, papingais, or crennis."

This association was evidently considered to be due to the bird imported by Solomon, and the favourite of Juno. In modern times the peacock has lost in repute; he has even been falsely epitheted in order to convey greater contempt; "a turned-up nosed peacock" is the unornithological remark to which we refer. To Gilbert White the screech of the peacock was "grating and shocking to the ear." "The yelling of cats," he adds, "and the braying of an ass are not more disgustful." To our mind the call of the peacock in the distance is far from unpleasant. Gilbert White made, apparently for the first time, an interesting observation upon the structure of this bird. He noted that the train of the peacock, which stands stiffly radiating outwards from the body in periods of excitement, was not produced by a lengthening of the true tail feathers—the rectrices, as their technical name runs—but from the feathers covering these above, the upper tail coverts in fact. It is inaccurate, therefore, to speak of the peacock's tail, if, that is to say, a comparison is implied with the tail of say a jackdaw. In long-tailed birds it

is as a rule the rectrices that are elongated. The plumage of "the gaudy Indian bird" is clearly its most striking peculiarity. It serves as an excellent instance to illustrate the way in which the colours of birds' feathers are sometimes produced. It will be noticed if a peacock's feather be held out and gradually moved round from one hand to the other that the shades change in hue. It will be furthermore noticed, that if the feather be rudely bruised the beautiful iridescent tints are lost. Finally, an examination of one of the green or blue feathers under the microscope shows merely a dingy brownish or black coloration. The gorgeous colouring disappears like that of "the purple jar." The explanation of these facts is that the metallic colours of the peacock's feathers are what have been termed "optical" colours. They are not, that is to say, due to the presence in the feather of pigments of a green or blue hue, but upon a pigment of black the various sculpturing of the outer part of the feather produces the greens and blues, just as a slice of mother-of-pearl shows different hues not present in the shell in the shape of pigment. There are, of course, many colours found among birds which are due to the existence in the feathers of corresponding pigments. Thus the red of the touracou, of which we speak on another page, is a definite red pigment. Both the common peacock and a variety or different species as some think it, viz. *Pavo nigripennis*, are to be seen at the Zoo. The interest of the latter bird is largely that it suddenly appeared as a distinct form, and since then has "bred true." It seems to be a genuine example of evolution by leaps and bounds! The pheasant tribe, to which the peacock, as already stated, belongs, is an Asiatic race mainly found in the tropical parts of that continent. The Argus pheasant, with its enormous train of eyed feathers, is perhaps the nearest ally of the peacock among the

Phasianidæ. But the differences which distinguish all the pheasants, *Gallus bankiva*, the origin of the domestic fowl, turkeys, partridges, and grouse, are but small.

The Mound-Builder.

With a perversity which characterized some of the earlier ornithologists, the Australian mound-builder (*Talegalla lathami*) was regarded as a vulture; and it was not until Sir Richard Owen explained its anatomy to the Zoological Society in the "forties" that its true place among the gallinaceous birds was fully established. And yet no bird bears upon it the outward marks of a "scratcher" more plainly than does *Talegalla*. "Brush Turkey" is so obviously more suitable as an appellation than "New Holland vulture," even to the least expert of bird observers, that one can have no pity for the stupidity which confused its relations with other members of the bird world. Its strutting and scratching alone betray it. In appearance the brush turkey or mound builder is not conspicuous, sooty brown being the main element in its colouring. It is rather from what it does than what it is that this bird is worthy of our attention. As a rule, there are examples at the Zoo: and also as a rule they construct their huge mounds of dead leaves and rubbish in which to place their eggs. Unlike the bird tribe generally, this fowl lays its eggs in common in such a heap, and leaves them to be hatched by the heat of the sun, aided no doubt by heat-producing fermentation within the mass. "Sic vos non vobis nidificatis aves" might well be said of this bird. For its nest is merely a nursery and no dwelling-house for the assiduous parents. It is a nursery, too, more on the lines of a crêche; for many families live together in one mound and leave their common home almost as soon as they are hatched; for in accordance with the "reptilian" mode of leaving

the eggs to hatch themselves, the young birds can fly when born, instead of emerging either as fluffy balls without proper feathers, like the common fowl, or naked and featherless lumps of fat, like the young hornbill. This extraordinary habit of nest building in common seems to us to be the extreme of the gregarious nest building of some other birds, such as the rook. Place the nests closer together and they fuse into a common dwelling. An intermediate state of affairs is offered by the sociable weaver bird, which builds a great "hive" with separate compartments for each pair of birds. The megapode is the last stage in the evolution of compound nest building, and the very mass of vegetable matter got together to form this common nest solves the problem of common brooding, for it renders it unnecessary. It is just possible that a stage still further on, and on the downward path, speaking in an evolutionary sense, is offered by the extinct solitaire of Rodriguez. This bird, according to Leguat, who knew it living three centuries since, erects a heap of palm leaves a foot and a half high, and sits thereon and upon a single egg. Perhaps this huge and inadequately constructed nest, implying great labour at the most critical period of the bird's life, has been its ruin, and it has really died out in consequence of diminished fertility and want of co-operation. Leguat speaks of the quarrelsomeness of the birds during the incubation period, which loss of temper may have led to the separation of the birds at the nesting season, the only relic of a former co-operation being the unformed heap which does duty for a nest, and which plainly recalls the mounds of the mound builders of Australia and the islands of the East. It has been intimated that the Megapodidæ are Gallinaceous birds. It would seem from certain points in their structure, particularly from the fact that the hallux or great toe springs from the foot on a level with the

other toes, instead of higher up, as in the barn-door fowl, that the nearest allies of the megapodes are the South American Cracidæ, or curassows. Such at least was the opinion of Professor Huxley, who described, nearly forty years ago, their osteology.

The Hoatzin

To include the hoatzin (*Opisthocomus cristatus*) among the list of birds to be seen at the Zoo is only, we are convinced, "an intelligent anticipation of events"; for it can only be a question of time before the energy of the authorities will submit to the public one of the most singular of living birds. It has been the subject of much scientific research, and of many highly "descriptive" paragraphs in newspapers. Its claims to notoriety are based upon the behaviour of the nestlings; they possess in an unusual fashion the capacity for scrambling about aided by the claws at the ends of two of the three fingers which constitute the wings of this, as of all other recent birds in which those appendages are not reduced (as in the kiwi). It has been termed on this account the "four-footed bird," a title which is clearly fully deserved in one sense; for it has, as have all birds, two pairs of limbs; but it is not so well earned in another sense, for all birds when very young are plainly unable to fly, and use to some extent their wings to aid in a confused movement, which may be called "scrambling." The hoatzin has, however, a legitimate interest, since it is one of those ornithological nuts which are extremely hard to crack. No one has as yet demonstrated to the satisfaction of every one else what is the precise niche to be occupied by *Opisthocomus* in the ornithological temple. It has been pushed about from pillar to post of that temple since De Buffon directed attention to its resemblance to the South American curassows. The balance of opinion allies it to the Gallinaceous birds, with a considerable touch of rail.

That is just what might be expected of an isolated type like the hoatzin, which seems to be a vestige of a formerly existing group. That it has been called "reptilian" by that distinguished authority upon bird anatomy, the late Professor Parker, F.R.S., is another way of expressing what are undoubtedly inferences to be drawn from its structure. An unpleasant but still accurate name for this South American bird is "stink Pheasant." It derives its characteristic and formidable odour from the berries of a certain shrub upon which it largely feeds. It builds upon these or other shrubs in suitable localities through the northern part of the South American continent. These shrubs overlook water, in which the hoatzin, both young and adult, is an expert swimmer. This is not so extraordinary as might appear. The saying of the hen with her foster ducklings is not by any means so neat a contrast between divergent habits of life as has been imagined. Professor Lloyd Morgan has found that a newly-hatched chick of the fowl will swim, and that in a regular and "hand-over-hand" fashion, not to be compared to a confused struggle for existence in an unexpected medium. Pheasant-like though it is (but here it is perhaps expedient to bear in mind the "dash" of rail), the hoatzin will swim and dive as one to the manner born. The hoatzin possesses at least two unique peculiarities of internal structure. Most birds—all except the struthious birds and a very few others—possess a deep "keel" to the sternum or breast bone, associated with the attachment of the enormous pectoral muscles, which pull down the wing in flight. In the hoatzin this keel, instead of fading away posteriorly as is common among birds, is deficient anteriorly, and this deficiency of keel is furthermore associated with, or any at rate combined with, a huge and baggy and muscular crop which rests upon this part of the sternum, and the whole upon the branch of the

tree upon which the bird is perching. One cannot but think with Dr. Gadow, that the undoubted inheritance of these characters is in favour of the transmission of acquired characters, that bone of contention among zoologists. It is as well to be particular even in describing a disagreeable odour. But statements by actual observers differ greatly as to the substance most generally known with which this odour is best to be compared. Mr. Quelch says: "Musk combined with wet hides." M. Deville said: "A cow-house." We incline to the cow-house view.

The Pelican

Pelicans are among the birds which do best in captivity, at any rate in captivity at the Zoo. This is shown by their extreme longevity in that institution. One individual, hoary with age, died only a year or two ago, having been inspected by the public since the year 1868. We do not know, of course, that this is not exceptional in another way; the pelican may have been cut off in the flower of its youth! The pelican is distinctly not of the wilderness, but of water courses, where it can swim and fish. No one can easily confuse a pelican with any other bird. Its large size, unwieldy proportions, and huge beak with dependent baglike throat for the storage of fish, betray it even to the non-expert eye. The top half of the bill has a little bend just at the tip to pinch effectively the slippery prey. The feet are webbed, very thoroughly webbed. All four toes are connected by webbing; and this is one, and indeed the chief, reason for uniting the pelican with the cormorant, the gannet, the tropic bird, the darter, and the frigate bird, to form the group Steganopodes; Professor Huxley called them Dysporomorphæ on account of the fact that the nostril is almost, or sometimes, as it appears, quite choked up by growths of

both bone and beak. This very odd state of affairs is unparalleled in any other living bird. There are certainly half a dozen species of pelican, perhaps more ; they are white, black and white, or even as in *Pelecanus fuscus*, dark brown in colour, and occur in most parts of the world. The "pelican in its piety" is a well known heraldic device ; it forms for instance the arms of Corpus Christi College, Oxford. Under these circumstances the pelican is represented as drawing blood from its own breast to feed its young. As a matter of fact the legend may rest upon the yellow to reddish tinge of the neck developed at the breeding season, which faintly suggests a stain of blood. This, coupled with the habit which all birds have of pecking at and fidgeting with their feathers, just as human beings bite their nails, may be responsible for that legend. There are no pelicans in England, though specimens escaped from captivity have been noted at times. But there once were pelicans ; for subfossil bones have been found in the fens of Cambridgeshire.

The Darter

Of darters there are four kinds, viz. *Plotus anhinga* of South America, *P. novæ-hollandiæ* of Australia and adjacent islands, *P. levaillanti* of Africa, and finally *P. melanogaster* of India, China and Madagascar. The bird—any of these species that happens to be on view at the Gardens—will strike the visitor as a somewhat exaggerated cormorant. Its neck is longer, its head is smaller, but its plumage is distinctly cormorant-like, as is the general aspect and behaviour of the bird. It would seem to have even a more than cormorant-like appetite, for a specimen that died in the Gardens some few years since was killed by swallowing in rapid succession a dozen small fishes. It is note-

worthy, however, that the darter cannot suffer much from the pangs of indigestion; for when the lining of the stomach gets somewhat defective it is simply shed *en bloc*, and a new one provided. This convenient method of restoring an impaired and dyspeptic stomach is at least not common in the animal world. The likeness of the darter to the cormorant is not deceptive, and it is more than skin deep. There is no doubt that it belongs to the same assemblage of birds as are characterized by their webbed feet, the webbing including the "big toe," or hallux to be more technical in diction. They are all fish eaters, but the darter seems to be unique among them for the way in which it pursues what in journalese would be termed its finny prey. *Plotus* swims and dives with extreme facility and rapidity. Its movements under water are as apt as those upon the surface, and as a consequence the bird has no difficulty in catching its prey, which it transfixes with the very sharply pointed beak. Rising to the surface it then tosses the fish into the air and neatly catches it as it descends. In order the more effectively to retain its hold upon the slippery and newly caught fish, the beak of the darter is furnished with minute denticulations directed backwards. *Plotus*, when on land and at rest, is seen to have an eagerly bent neck craning forwards as if on the look-out. This impression is produced by a kink in the neck, due to a sudden change in the direction of the several vertebræ after a certain point. The muscular mechanism attached to the kinked part enables the beak to be shot out forwards with great velocity, and is the means whereby the darter spears its prey. When swimming as opposed to diving beneath the waves, the darter closely resembles the cormorant; for its long neck appears above the water while the body is nearly completely submerged.

SOME STRUTHIOUS BIRDS

The Cassowary and the Emu

There is really no such thing as *the* cassowary at present, but there was so long ago as the very beginning of the seventeenth century, when the first live bird of this genus *Casuarius* was brought home and exhibited alive in Amsterdam. We now know of quite eight "good" species, and systematists would increase, as is their wont, even this respectable number to twenty in all, including those dubious creations of the naturalist, "sub-species." A fine series of cassowaries has been on view at the Zoo for some years past, the collection being due to the energy of the Hon. Walter Rothschild, to whom most of the birds belong. The veriest tyro would rightly place these birds in the neighbourhood of the ostrich, the emu, and the rhea—among the struthious birds in fact; and that is unquestionably their place in the system. Their nearest ally is the emu, and the two genera were at one time confounded. Now we regard them as distinct. The cassowaries differ from the emu by the horny black casque upon the head, by the enormously lengthened nail of the innermost of the three toes, and by the stiff spine-like feathers of the wing, which are ordinary feathers devoid of barbs, and finally by the very gay colours, red, yellow, blue, purple, and green, about the head and neck. Besides, the cassowaries are not Australian birds exactly—since only one species is found in that island continent, and then only in the north; they inhabit New Guinea and such islands in the neighbourhood as Ceram, New Britain, etc. Unlike the ostrich, the cassowary is a forest living fowl, and it has been said that its casque is of use in this habitat. Rushing wildly through the bush the head is held down and the entrapping brambles glide off the polished surface of the helmet. The black feathers of the adult bird are preceded by brown feathers in the

immature, and by a striped back in the very young, bird. The gaudy colours of the neck are sometimes continued into one median and one or two laterally placed wattles, which are shaped like the bands of a "clerk," and the presence of which have given rise to two specific names of cassowaries; these are distinguished, according to the presence of one or two of these wattles, as *C. uni-appendiculatus* and *C. bi-carunculatus*. It is easy enough to say that the brilliant hues of the naked skinned throat are due to sexual selection; but there is no doubt that they now occur in both sexes, and so they have been at any rate transferred from one sex to the other, and can no longer be reckoned as sex attractions. Cassowaries are quite diurnal birds and sleep peacefully during the night. Their voice has been described as "a curious sort of snorting, grunting and bellowing." They have no proper voice organ comparable to the syrinx of other birds. In disposition the cassowary has the reputation of being "sullen and treacherous," and there is no doubt that it had better be approached at the Zoo with due circumspection. For the bill is strong and so are the toes. Its food is mostly vegetable, though insects are apparently not scorned. It is a good swimmer, which may account for its occurrence on widely separated islands. The large dark green eggs are known to everybody; but everybody may not be aware that they are excellent eating. The bird itself is not altogether despicable from the gastronomic point of view. There is one story related of the cassowary which may be true, but does not bear the generally recognized hall mark of truth, repetition. A traveller in Australia observed one of these birds to enter the water and to squat down for a few moments. It then deliberately waded to the bank and shook from out its wings a multitude of small fishes, which it proceeded to devour. The suggestion

CASSOWARY

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is that the fishlets mistook the waving feathers of the bird for water-weed, and nestling there fell a prey to their deception.

The Kiwi or Apteryx

The peaceful kiwi gave rise some years ago to a rather warm controversy between the leaders of zoological opinion. To Sir Richard Owen it appeared to be the long wanted link between the equally warm blooded mammals and birds, which that anatomist bracketed together in the series on account chiefly of the warmth of their blood. The slightly higher temperature of the blood in birds was thought by him, and so far naturally, to be less of a bar to their association with mammals, than the pure cold-bloodedness of the sullen reptile, to an association with the birds. Professor Huxley, however, insisted upon the close alliance of birds and reptiles and plainly showed that certain supposed resemblances between the apteryx and the mammal in the midriff or diaphragm had no real existence, and that the apteryx was typically ornithic. Now a middle position between these two extremes is held. We do not consider the bird as in any way near to the mammals ; but we consider them to be quite remote from the reptiles and not to be placed with them in one great group. Nevertheless, we admit a closer position to reptiles than to mammals. The apteryx is one of those birds which it will be difficult for the visitor to get a peep at. It is quite nocturnal in habit, and snuggles down during the day in such retirement as is provided for it. At night it sallies forth, and in New Zealand, where it alone occurs, devotes itself to extracting earthworms from the soil. With great deliberation does it drag these wriggling creatures from their holes, as if realizing that earthworms like beefsteak thrust into the pocket must " be

humoured not drove." In harmony with its crepuscular and nocturnal life the kiwi is coloured of sad browns and greys, a mode of coloration which we meet with in owls and goatsuckers, equally nocturnal as a rule in habit. The name apteryx is quite a misnomer. The kiwi has wings, though they are very minute and hidden by its long feathers; these lack the firmness of the feathers of other birds by reason of the fact that the branches of the main axis of the feather, the barbs, lack those secondary branches hooked together called the barbules. The bones of the wing are, however, like those of other birds, save for the fact that only one of the three fingers found in the wings of other birds is at all well developed. The long bill of the kiwi and its relationship, as it is thought, to the ostriches, has led to the apt German vernacular name of "Schnepfestrauss," or "snipe ostrich," an appellation which is clearly more descriptive than apteryx. It is this long bill which is used in probing for earthworms, and it has, contrary to what is found in other birds, the two nostrils situated quite at the end. This allows the bird to snuff down into the hole it is probing for the earthworm, and it appears indeed that the kiwi has a better sense of smell than most birds. Smell, indeed, is a sense in which birds generally are apt to be deficient; they make up for it by extreme keenness of vision. The apteryx is one of those birds, and here it agrees with other ostrich-like birds, in which the female is the more agressive of the sexes, while the male is more retiring and attends to the duties of incubation. The nest is a scooped out hole in the ground and in it are deposited, or rather *is* deposited, the enormous egg. It is a fact that proportionately the egg of the apteryx is the largest known, being not even exceeded by that of the roc or *Aepyornis*, or, more paradoxically, by the smallest egg in actuality in the bird series, i.e. that of

KIWI

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the humming birds. The mysterious nature of the kiwi is emphasized by its weird silence even when attacked by beasts or handled by man. For it can cry and does during the breeding season, the cry being, as it is supposed, a means of communication between the two sexes. The female has the louder and a husky voice, the male has a more piping call, the voice difference being in accord with the reversed relative positions of the male and female bird. The reserved character of the kiwi has led to the supposition that it was rarer than is actually the case, and has given rise to myths. One of these legends concerns its mode of incubation. It was held that the apteryx fell in with the general topsy-turviness of things antipodean, and after building a nest incubated the young from below. This fable was disproved by the nesting of a pair at the Zoo a good many years ago.

The Rhea

The South American ostrich is coloured of an agreeable grey with black wings, a plan of colour which is, in fact, not widely different from that of the hen ostrich of Arabia and Africa. It is, however, quite a distinct bird with no more than general points of resemblance to its Old World relative. As the two birds are as a rule to be seen side by side in enclosures at the Zoo, their points of difference as well as of likeness can be easily appreciated. The ostrich has a larger body, but rather more feeble wings ; its toes are but two, and the difference between the two sexes is at once apparent ; the male has the fine black and white plumes so desirable in commerce. The rhea has quite good wings for a ratite bird, so good that it could almost fly if the feathers were not of the usual limp character of those of the ratite or struthious birds. It has also a more perfectly framed organ of voice than its struthious allies,

though whether this is of much advantage is doubtful, considering its silence. In any case these facts seem to point to a shorter period of flightlessness in this than in the other members of the great ostrich-like birds, which culminated in the huge moas of New Zealand and the roc or *Aepyornis* of Madagascar. There are three different kinds of rhea, and it is interesting to notice that one of these, called after Darwin, *Rhea darwini*, has a rather spotted plumage suggestive on one colour theory of greater antiquity. It has often been pointed out that stripes and spots are not only found in the young of many creatures which are unspotted and without stripes in the adult condition, but that low forms of animals are more variegated in this way than higher types. Like the struthious birds generally, with the exception of the apteryx, whose claims to be associated with them are less, the rhea is by no means invariably a mild-tempered fowl. As is so common with the animate creation, the excitement of the breeding season finds a vent in continued hostility to any approaching man or beast. Mr. Hudson considers that it is positively dangerous to come within the range of vision of a cock rhea who is engaged in watching the laying of eggs by his numerous suite. Though ferocious to strangers, the cock bird performs himself the severe duties of incubation, a procedure in which he resembles other ratites. At other times the rheas seek the society of other beasts, and are reported to occur among herds of deer with which they are on terms of amity. It has been pointed out that in this the rhea simulates the ostrich, which has a similar fondness for frequenting herds of zebras.

GOLD CRESTED PENGUIN (*Eudyptes chrysocome*)

This bird, like others of its tribe, is limited to the Antarctic region. The penguins inhabit the shores of

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the various islands of the Antarctic ocean, from the Falklands in the west to New Zealand in the east, and as far north only as to the Cape of Good Hope. They are almost alone in their limitation to this region of the globe. Within this cold and inhospitable, though fish-teeming, expanse, the penguins are represented by a considerable number of forms, which have been arranged into at any rate five different generic types. These are *Aptenodytes*, *Spheniscus*, *Eudyptes*, *Eudyptula* and *Pygosceles*. Our particular type and five or six of the rest have been frequently on view at the Zoo, where they attract great attention from their grotesque form and their easy and lithe movements under water. On shore, and at the brink of their pools at the Zoo, they waddle or hop awkwardly ; a small penguin which was some years ago in the renovated Fish House was clad on occasions by the keeper with a little coat, and hopped more energetically than, but with something of the air of, an elderly and obese gentleman. In fact the first observers of penguins took them, from their upright position and from being drawn up in lines, to be soldiers prepared to repel an invasion of their fastnesses. Far from being so prepared, the bulk of penguins are or were, for they may be in places a little more sophisticated, stupidly unaware of intended harm, and they could be knocked over by thousands with a stick. Obese penguins always are, as their very name, which is supposed to be connected with the Latin "pinguis," denotes. Some ingenious commentators have sought in Pen Gwin, i.e. "white head," a derivation of the pseudo-vernacular name by which everybody knows them now. The penguin is not a good goer upon dry land. His legs, rather swaddled up in skin, do not permit of an easy stride or even an efficient hop. But as the bird never goes away far from the sea, its proper home, this unfitness is not a serious matter

for the future of the penguin. Furthermore, the barren shores which they haunt do not breed fierce carnivorous creatures to assault them when on the nest. In the water the penguin swims with the greatest elegance and with a peculiarly buoyant motion that suggests a positive flight; this, if the water be clear enough, will certainly be the delusion of the onlooker. Black to brown above and with a white belly is the prevailing hue of the penguin tribe, and the species which we select here, as well as some of its immediate allies, have a streak of yellow feathers upon the head, which relieves this dull coloration. Swimming in the water with the paddles extended, the black back, with occasional views of the white underparts, quite suggests, when the animal is seen from above, one of the dolphin tribe, to which the long beak and the abbreviated tail adds not a little in the way of resemblance. Further, the yellow about the head is repeated in some dolphins, while the flippers of the bird are by no means widely different to outward view from the swimming fore limbs of the dolphin. It has been pointed out, too, that this penguin will at times spring clean out of the water, and when a flock, if we can apply the term flock to anything that does not live in air or on land, rise out of the waves in rapid succession the appearance of a shoal of porpoises is distinctly simulated. So aptly constructed are the penguins for a life on the ocean wave that one hears with surprise a story to the effect that the shores of certain parts of New Zealand are sometimes littered with the corpses of the small penguin, *Eudyptula minor*, which have perished in the surf. Besides its paddles, its short neck, its generally whale-like outline, and its strong swimming feet, the penguin is eminently fitted for a submarine life by its unusual fatness, and by the close coating of feathers which decks its body. In almost all other birds a careful examination will show

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that the feathers are disposed in definite tracts, whose arrangement varies from bird to bird, and often affords valuable evidence of affinity : between these tracts are either naked spaces or spaces sparsely covered with scattered small feathers. The penguin, on the other hand, has a " pterylosis," which is continuous all over the body, save, as it appears, for a small region on the under surface, which is pressed upon the eggs when the bird is sitting on its nest. In this way the eggs get more of the heat of the body ; for, as is well known, feathers are bad conductors of heat, and are thus useful for keeping a bird warm, and us when we use feather muffs, duvets, etc. It is a remarkable fact that this little bare patch only occurs in the female, and yet both sexes sit upon the eggs. Perhaps it argues that the share of the father in the well being of his offspring is only a recent occurrence, and that formerly the hen alone performed this important function. This feathering of the penguin is supposed by some to indicate the retention of an archaic character. And if the feathers of a bird may be derived directly from the scales of some reptile forefather, an uniform feathering would naturally be the original condition. Speaking of the scales of some reptilian ancestor, it is a most noteworthy fact that the difference between a scale and a feather is reduced to an apparently irreducible minimum in the paddle. Flat, closely depressed and unbarbed " feathers " cover that member, and it was discovered by the late Mr. A. D. Bartlett that the skin of the fore arm is shed in a piece, like the skin of a snake, instead of being moulted in bits like the feathering of a fowl. Another ancient character (at least in the opinion of some), which the penguin shows is the fact that the three bones in the foot known as the metatarsals, those bones which lie between the ankle and the commencement of the bones of the toes, are slightly separated

from each other instead of being fused into a single piece, as in other birds. The penguin, when at home on shore, dwells in " rookeries." These differ from the rookeries of rooks by being situated on the ground, though the individual nests are carefully made by each bird out of plants. These " nurseries " are placed away from the common dwelling places of the rest. The rookeries, like those of old London, are a pandemonium of noise at times, which is described as being like the barking of myriad dogs in many keys. The penguin has also the weird habit of rising out of the water and saying " Whaat " in a sepulchral tone. The largest penguin is the great *Aptenodytes pennanti*, called after Gilbert White's correspondent, known as a naturalist, but better as an historian of London. This bird reaches a total length of three feet. But it was eclipsed by a giant, now extinct, of five feet in length known as *Palæospheniscus*, which once inhabited New Zealand. It is useless to tempt the penguin with buns. Fish is its only food, which it pursues living and catches with ease and in a somewhat different way to the darter, who transfixes the prey when caught and catches it again.

PENGUIN

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CHAPTER VIII

Reptiles

THE reptiles are the only vertebrates which are cold-blooded and which without exception breathe by lungs and never at any period of their lives breathe by gills, as do the fishes always and the amphibia for a portion of their lives. They have also invariably a scale-covered skin, in which also there may be supplementary bony structures, such as the bony part of the "box" of the tortoise, and the strong plates in the skin of crocodiles. They possess neither feathers nor hairs. The skull is fixed on to the succeeding vertebral column by one rounded joint or condyle as in birds, while the mammals and the amphibia have two of these, one on each side. It is from the amphibia that it is most difficult to divide reptiles, a fact which is embodied in the confusion of the two into one group, called "reptiles" by some of the older authors, and "amphibia" by some others. In past times, as is natural on any theory of evolution, the reptilia and the amphibia gradated into one another, and no very hard and fast line can be drawn. The living representatives of these groups can, however, be distinguished by the characters already enumerated. There are other anatomical characters into the consideration of which we shall not enter here. The most obvious character of the reptile is its complete covering of scales. Some extinct groups, such as the Ichthyo-

saurs, seem to have had smooth scaleless skins, but no living reptile is without this tesselated armature. The existing reptiles are to be divided into five orders, but their numbers to-day are much below their numbers in past times. The reptilia are clearly a waning race as a whole, though of the existing orders most are more numerous now than they ever have been so far as the geological evidence at our disposal enables as to say. As to their numbers to-day, Dr. Gadow asserts that there are about 3,500, so that there are more reptiles than mammals, but considerably fewer than there are fish and birds ; for of the latter we know some 10,000, and of fishes some 8,000, while there are something like 2,700 mammals and about 1,000 amphibians. The enormous majority of living reptiles belong to the groups of lizards, snakes, and tortoises. There are but few crocodiles, and *Hatteria* is the only living example of its own group.

Lizards : the Order Lacertilia

The only other reptiles with which the lizards could be possibly confounded are the crocodiles, snakes, and the New Zealand *Hatteria*, which is the sole living representative of an otherwise extinct order, Rhynchocephalia. The turtles and tortoises are so distinct that there is no danger of confusion for the most ignorant of Natural History. From the crocodile tribe the lizards are to be distinguished by a variety of characters, which are, however, deep seated, and thus not easily appreciable to one examining the animals in a menagerie. As to purely external characters, it is most difficult to draw a line. In the crocodile tribe the nostrils are very plainly on the upper surface of the snout and protrude somewhat, which is of course in relation to the aquatic life of these creatures. The vent is a longitudinal orifice and not a transverse one as in

lizards and snakes. The size is greater than that of any lizard; but it must be remembered that a large monitor lizard comes not far behind a smallish crocodile. Crocodiles are invariably aquatic, lizards are very rarely so. We must necessarily mention a few internal characters to emphasize the separation of lizards and crocodiles. In the latter the teeth are always confined to the upper and lower jaws; in lizards they stray on to the bones of the palate in many cases; furthermore each tooth of a crocodile is implanted in its own particular socket, while in lizards the teeth are attached side by side to the bones which bear them without lying at some distance apart and each like a peg in a hole in these bones. The heart of the crocodile is more completely four-chambered than is that of the lizard, in some of which, however, there is a tendency in the same direction. On the whole the lizard tribe is on a lower level of organization. Lizards are excessively numerous and occur in almost all parts of the world, except in very cold regions, such as the extreme north. They chiefly abound in the tropics. The general aspect of a lizard is familiar to every one. But it is not so easy as it seems to differentiate a lizard from a snake. For among the lacertilia there is a distinct tendency to lose the limbs, an event which has occurred in many of the families into which the order is divisible, and thus produces a likeness to a snake which is after all superficial. Nevertheless, the two orders, the Lacertilia and the Ophidia, are very nearly akin. Some differences between them will be dealt with later.

The Heloderm Lizard

Of lurid coloration is the Arizona heloderm, or "gila monster" as it is often termed in the United States, in the southernmost of which it lives. There would

appear to be two distinct kinds of heloderma, viz. *H. suspectum* and *H. horridum*. One epithet is good, the other bad. It is truly "horrid" in the applied as well as in the literal sense of that adjective, for the skin is roughened with warty scales underlain by bony nodules. "Suspectum" is too dubious an adjective; for this lizard is not merely suspected but known to be poisonous, being in fact the only lizard which has this qualification. It was thought some little time ago that the rare *Lanthanonotus* of Borneo was also poisonous; but recent study has proved that, while related to *Heloderma*, it lacks the grooved teeth of the latter. Experiments tried with *Heloderma* as the main actor with the subsidiary parts played by various frogs and guinea pigs has satisfied every one that this lizard does bite with a poisoned effect; moreover the salivary glands, or rather some of them, are furnished with several ducts which open in close apposition to the grooved teeth; along the grooves run the poison which is thus necessarily injected into the wound made by the teeth. In fact, the gila monster poisons precisely in the same fashion as the venomous colubrines, those non-viperine snakes which are poisonous. On the other hand, the courageous Dr. Shufeldt allowed himself to be bitten by one of these lizards, but experienced no serious inconvenience "beyond the ordinary symptoms that usually follow the bite of an enraged animal." Like most lizards this animal is lethargic and melancholy in appearance in captivity. It seems indeed to have fewer and shorter repetitions of those periods of briskness which even the most sedentary of lizards show at times. It can, however, be roused, and then its wrath is terrible. Under these circumstances, observes Dr. Shufeldt, "the animal quickly rears its body from the ground by straightening out its limbs, wheels about, opens its mouth widely,

snaps its tongue in and out, and gives vent to a threatening blowing sound." Further provocation involves bite or bites; but the lizard is on the whole of the general opinion with regard to the tempering of valour by discretion; for it takes as early an opportunity as possible of continuing its retreat. The heloderm has a nauseous odour, which it as a rule scatters about at night, being as it is nocturnal for the main part. Its colour demands some attention. The sullen and gloomy aspect of the beast is largely due to the pitchy black of its skin relieved, or rather heightened, by patches of orange, which orange changes at times to a salmon pink. This startling contrast of yellow and black is one of those especial plans of coloration which have been termed "warning colours." It is exactly paralleled by the variegated salamander of Europe, by the wasp and the hornet, and by the caterpillar of the "cinnabar" moth. All of these last-mentioned creatures have some disagreeable habit, such as stinging or tasting nasty. Many persons, putting twos and twos together, have arrived at the conclusion that the vivid and easily recognizable colours are an advertisement of this ferocity or inedibility, and may be translated into the phrase "Noli me tangere." Nor is this due to a kindly altruism on the part of the yellow and black ones. It is simply this; a conflict with an enemy would doubtless result in the defeat of the enemy, or its poisoning by the nasty taste; but at the same time the salamander or the heloderm would get mauled in the gastronomic attempts of the attacking bird or reptile. It therefore suggests by its colour that to be severely let alone is on the whole the best way of procedure. The heloderm eats all kinds of things in the animal line, worms, insects, and even eggs. It doesn't appear to be a cannibal, which is saying a good deal for a carnivorous reptile.

The Slow-worm and the Amphisbæna

This homely little creature will serve as a type of those numerous lizards which have deserted the straight road of reptilian development, and gone and lost their legs as if they were mere snakes. It is seldom that the Reptile House is without the slow-worm or blind-worm as it is usually called; it must be remembered that in terming it a worm nothing contemptuous or even wormy in the ordinary sense of the word is intended or implied; the word worm is good Scandinavian for snake, and the name thus perpetrates a zoological error of a lesser kind. Why the worm under debate is not a snake is a question that many would find it hard to answer. And why "blind" is a further question much to the point. The blindness is here with the observer who first gave it the name and not with the lizard. It has good, even particularly good, eyes, sharp in their outlook, and provided, as are the eyes of nearly all lizards, with movable lids. Here, then, is the first reason why the *Anguis fagilis* is not a snake; for no snake has eyelids. If the slow-worm be fed it will be noted that it eats in the usual lacertilian fashion, and does not divaricate its distensile jaws, getting outside its food as a snake does; in fact the two lower jaws where they meet are firmly united and not merely joined by a lax ligament as they are in all except a very few kinds of snakes. Other and satisfying reasons for placing the slow-worm among lizards can be seen only after an anatomical examination. Snake-like lizards have at least vestiges of limbs, which are completely wanting among snakes except the merest traces in some few forms, the boas and their immediate allies. No snake has a breast bone or sternum. These are some of the reasons—there are plenty of others—why the slow-worm is a lizard and not a snake. The slow-worm is perhaps the commonest of British reptiles. But

it is not so frequently seen as the more active common lizard *Lacerta agilis*, on account of its retiring habits. Unfortunately for itself the slow-worm does not dislike, indeed it seems to prefer, the neighbourhood of human habitations; this is unfortunate, for the animal has succeeded in gaining a most terrific reputation for poisonous properties, of which it has not the slightest hint. It has thus suffered much persecution by hob-nailed boots. It is true that the slow-worm will bite at times, especially during the breeding season, which seems to be productive of irascibility in the animal world generally. But its tiny teeth will not scratch, let alone bite, the human skin to any purpose. It has been pointed out, however, that this reptile has some of its teeth grooved. Now that is a character of the only known poisonous lizard *Heloderma*, and of certain snakes known as venomous colubrines. But there is no developed salivary gland in association with these grooved fangs, which are, however, sufficient to retain a hold of slugs, which the slow-worm particularly affects as food. *Anguis fragilis* occurs nearly all over Europe, avoiding the colder northern regions; like most other reptiles it is not to be found in Ireland. It brings forth its young alive like many lizards, but this process must not be confounded with the mammalian method of gestation. For in the snake the eggs are merely retained in the oviduct until they are hatched; there is not any connexion by growth with the parent as in the mammalian fœtus. The family to which *Anguis fragilis* belongs, the anguidæ, contains a number of other forms of which some are legless, and others possess the normal complement of three appendages. The large grass snake of Russia and Morocco, often to be seen at the Zoo, grows to three feet or so in length and is much like an enlarged edition of the slow-worm; but it has, which the slow-worm has not, a deep groove

along each side, of which the use is problematical. It has the reputation of being tamable and intelligent. Lizards generally show a tendency to lose their limbs. There are many other families in which some members have reduced themselves to the condition of grovelling along upon their bellies. Always, however, there is some trace recognizable by the anatomist of the otherwise missing appendages. The most thoroughly snake-like of living lizards are the amphisbænas, a race which is chiefly American and African. But even here there is one genus in which the fore limbs are retained. There are not uncommonly amphisbænas to be seen at the Zoo. The name is at most as ridiculous as that of blind-worm, and has been given to them on account of their short tail and blind face, rendering thus a confusion between anterior and posterior possible, except to the careful observer. The tropical American *Amphisbæna* is especially fond of taking up its quarters with ants, for choice the sauba ant. The ants, as a rule a bloodthirsty race, apparently regard these creatures with affection, or at least do not interfere with them. But then ants have queer hospitable notions towards various creatures of the animal world, and an ant-hill generally contains an odd assortment of beetles living under their protection, and apparently incapable of living anywhere else. The ants are, like the brigands of the transpontine melodrama, bloody and fierce as a rule, but occasionally yielding to the softer emotions. Their apparently bidden guests, so varied in character and kind, remind one of the curious assemblage, the cat, the black servant Frank and blind Miss Williams, collected beneath his roof by Dr. Johnson. As to the *Amphisbæna*, Mr. Bates remarks that it is exceedingly sluggish and remains within the ant-hill all day, and only comes forth at night. Naturally the native thinks the *Amphisbæna* poisonous ; he also states that

if the lizard be forcibly abducted from the ant-hill the ants will leave in chagrin and found another colony. In the south of Europe lives *Blanus*, an ally of *Amphisbæna* which prefers manure heaps, where it finds and eats earthworms, to ant-hills.

That so many different families of lizards should show an equal capacity for more or less completely losing their limbs makes the transition between a snake and a lizard easy to imagine; and also shows us that the snake may be a quite composite group perhaps derived from different groups of lizards.

The Tokay Gecko

This, the great house gecko of the East, is commonly on view at the Zoo, where it may be recognized and distinguished from other geckos by its large size, measuring as it does a foot or more in length, and by its marked and not unpleasant coloration; this coloration consists of red spots and marks upon a greyish green ground. Geckos as a rule are not big lizards, indeed their capacity for running up vertical walls, and even crossing ceilings suspended head downwards, would seem to forbid a great bulk; even as it is their attitude seems to show a striking variance from the laws of gravitation. They stick, however, by a peculiar mechanism quite analogous to that by which a piece of glass may be made to adhere to another piece of glass by simple pressure. The toes of the gecko are covered with fine folds lying in parallel rows; these when firmly pressed down upon a smooth surface drive out the underlying air, and as a consequence atmospheric pressure assists the foothold of the lizard. This mechanism, so essential to the house-loving ways of the gecko, is not, however, peculiar to these lizards; other lizards, such as species of the genus *Anolis*, allied to the *Iguana*, whose peculiarities have been treated of on another page,

which habitually walk about on smooth and slippery leaves and branches, have the same lamellæ upon the toes. This statement by no means exhausts the peculiarities of the gecko tribe, which includes some of the most remarkable among lizards. Outwardly they are quite unmistakable lizards : but of the majority it will be noticed that they stare with a protracted gaze unbroken by a wink. This is due to the absence of eyelids and the covering over of the eye by a transparent membrane, which gives to the look of the reptile the unwavering and coldly unsympathetic glance of the snake. Like some other lizards, the geckos fracture their tails, or rather allow them to be fractured, with the greatest impunity. This is a great boon to them, for a waggling tail is clearly that part of the animal which is most likely to be bitten at by a bird in pursuit. The easy breakage of the tail and the ease with which it is subsequently repaired by its former possessor, enables the gecko to successfully brave many dangers incidental to an exposed and reptilian life. There are certain features in the skeleton, which imply an ancient history for the geckos ; for instance, the notochord, that softish gristly rod which is the forerunner of the vertebral column, and which persists largely or entirely in fishes, is also largely persistent in these geckos. The tokay itself is found in many parts of the East, and, like other geckos, and unlike lizards in general, it has a voice which is described by Captain Flower as consisting of the word "tokay" pronounced several times "after a preliminary cackle." The native of Siam uses this voice as a means of gambling ; bets are taken upon the number of times that the word "tokay" is pronounced by the lizards, which is usually seven or eight, but sometimes as many as eleven. The tokay can also puff and hiss, and is so far merely lacertilian and not geckonine. It lives in houses and is

bold, occurring in the most frequented rooms of those houses. Geckos, like most lizards, are carnivorous in habit. This giant form, relatively speaking, eats insects, small birds, and is even at times a cannibal. So firmly can it adhere to surfaces that it is used in the pastime of fishing for hats with felonious intent ; the gecko is let down on to the hat of some unsuspecting passer by, and is hauled up together with the hat, just as the remora or sucking fish is used to fish for turtles. Geckos are very numerous in species ; nearly three hundred exist, and they are found all over the world in its warmer parts. The nearest point to this country where they occur is the south of France, where lives *Tarentola mauritanica*, a smaller species than that which we have been considering. The visitor to the Zoo will not have the opportunity of seeing so large a number of species, for something under twenty is the total number of different forms which have been on exhibit in that institution.

The Frilled Lizard

As the frilled lizard, *Chlamydosaurus kingi*, has up to the present been only once exhibited at the Zoological Gardens, it is possible that this chapter may not be of great use to the visitor ; on the other hand the reptile seems, according to Mr. Savile Kent, to be not uncommon in Queensland and some other parts of tropical Australia, and it is always possible, therefore, that there may be specimens on view in Regent's Park Gardens. It is in fact frequently the case at the Zoo that an animal reputed rare has subsequently turned up in greater numbers, so as to be no longer a rarity at the menagerie. The frilled lizard belongs to a family known as Agamidæ, concerning which we shall have something to say by way of an appendix to the account of the representative of the family which has

been selected to exemplify it. This agamoid is a foot or so in length, exclusive of the long and whip-like tail. It is of a brownish colour generally but its most prominent feature, the frill, more than Elizabethan or Jacobæan in size, which encircles the neck, is splashed and spotted with vivid red. This fiery and glowing fringe seems to lead into an equally glowing mouth armed with teeth and with a lurid yellow tongue, the sum total of these peculiarities being not unalarming to the pursuer. This frill or rather mantle opens in an umbrella-like fashion ; the skin of which it is composed is strengthened by a "rib" derived from the hyoid or tongue bones. When not in use it depends elegantly over the shoulders. No special action on the part of the reptile is needed to expand the frill ; it has merely to open its mouth and the very act of opening the mouth divaricates the ribs, and expands the mantle. This process reminds one of the poison fangs of the viper, which are brought into position for biting by the mere action of opening the mouth ; when the mouth is closed the fangs lie in a harmless longitudinal position. As for the frill itself, the most obvious thing to compare it to is the hood of the cobras, which with it is indeed precisely analogous as far as we can judge. It is a "scare organ" intended, so at least it is presumed, to warn off aggressors by a show of violence, which might forbid more effective measures of retaliation These methods of indicating rage and determination are not uncommon in the animal kindgom ; but at times they are not much more than bluff. In the present case the reptile can carry out its threats to some extent. It not only bites but lashes in a stinging fashion with its long and lithe tail, a kind of pugnacity also shown by the iguana. There is more, however, that is worthy of note in the *Chlamydosaurus* than this mantle, which gives to it its scientific name. Lizards

are, as a rule, eminently quadrupedal; they progress as we have already observed, slung between their fore and hind limbs like an eighteenth-century coach between its hind and fore wheels. When bounding over level ground the frilled lizard abandons the use of its fore limbs, and hops kangaroo-like for yards together before coming to rest. This odd mode of progression is normal, remarks Mr. Savile Kent, "when the animal is traversing level ground for any distance." and the distance so travelled may be as much as thirty or forty feet without a stop. It then rests for a bit on all fours and afterwards resumes its leaping progress. It has been justly pointed out that in this the *Chlamydosaurus* reminds us of the extinct Dinosaurians, a race of reptiles of all sizes from eighty feet or so to a foot or two, which flourished in long bygone ages, and have left no living trace of themselves to-day. But the recollection of the similar mode of progression of some of these dinosaurs must not lead to the view that the *Chlamydosaurus* is their long lost heir. The modern group of lizards has not much in common with those great reptiles of the past, who are much more nearly related among living animals to the crocodiles and to birds.

The family of the agamidæ, to which this lizard belongs, represent as it were the iguanas of the New World in the Old, and they are especially common in Australia. There are over 200 species of them placed in many genera of which several are usually on view at the Zoo. *Uromastix*, with its spiny tail, is perhaps the one most commonly to be seen; but the Australian *Amphibolurus*, the "Jew lizard," with its "Newgate fringe" of thick spines, is also at times accommodated in the Reptile House. The agamidæ are, as has been mentioned, by no means unlike the iguanas, and it is at least a curious coincidence that in both families

there should be a type which has contracted the most striking likeness to a chamæleon. The agamoid chamæleon is *Lyriocephalus scutatus*, the iguanoid mimic *Chamæleolis*. The latter has been an inmate of the Reptile House but not the former.

The Teguexin.

The scientific name of this South American lizard, viz. *Tupinambis teguexin*, is due to a curious error. The traveller, Marcgrave, speaking of the lizard, remarked that it is named Teyu-guaco, and, among the Topinambos, Temapara ; after reading this, Seba, the collector of "curiosities," jumped at the conclusion that what Marcgrave meant by Topinambos was the name of the lizard itself. The name got into zoology, and the rule in zoology is a stern one as to priority ; so we must perforce give to the lizard the name of the tribe, thus reversing what sometimes happens when an Indian individual or tribe is called by the name of an animal. The Teguexins or Tupinambis are a group of lizards containing a vast number of species all confined to America, and most of them to South America. There are usually to be seen at the Zoo examples of the two species, *Tupinambis teguexin* and *Tupinambis nigro-punctatus*. They grow to some size, and are bluish, variegated with yellow marks. For some reason or other they have been confounded with the monitors of the Old World to which they have not the very faintest structural resemblance. In fact, no two groups of lizards are further apart than these two. However, they both love the water, and are somewhat fierce. In fact, the Tupinambis is said to emulate the bull-dog in the tenacity with which it will hold on to any aggressor. The name of "safeguard" has been applied to these lizards, on the supposition that like the monitors they will warn of the proximity of a crocodile. They are strong and swift, and lash out with

their tails like many other lizards, and like crocodiles. At the Zoo, like most other lizards they slumber much, and do not suggest any great activity either of mind or body. But they are big and impressive in appearance.

The Chamæleon

The "reptilian vicar of Bray," as the late Mr. Grant Allen termed this lizard, has got an unjust reputation for capacity of colour change, mainly due to a well-known ballad, where these changes lead to misunderstanding on the part of some who have not been present to witness the whole series. As a matter of fact the chamæleon does change its colour, and incidentally and at the same time, unlike the leopard, its spots. But these changes are not precisely what they are in popular imagination, which will accordingly be disappointed when the Chamæleons at the Zoo can be got to "perform." Popular imagination in this, as in other matters, has raced well ahead of the facts, and has assigned to the chamæleon the entire chromatic scale. Its actual performance falls far short of this, and is limited to greens, yellows, browns, greys, and almost blacks. Some colours are beyond their powers. Nor can they entirely blanch or blacken. The faculty of colour change, though characteristic enough of these singular lizards, is by no means confined to them ; it is a common attribute of many lizards, some of which even excel the chamæleon in their variety and rapidity of change. The chamæleon, however, is a fairly quick change artist. Apparently rage is the most potent factor in inducing alterations, and a chamæleon, when pinched gently, becomes spotty with wrath. Sunshine blackens them, and death leaves them black or pale straw colour. In fact, anger, heat, cold, and death, would seem to be the main factors in turning their coats. That chamæleons are lizards is probably known to most, but in almost every feature they differ from the more

typical and nimble, scaled, creatures that are called by that name. To watch a chamæleon in the Reptile House side by side with a lacerta for example, will bring out so long a series of differences, that it seems almost necessary to establish another order for these divergent creatures. Their prehensile tail is unique among limbed reptiles, and its very prehensility is remarkable, for it only works downwards : the toes are bound together in threes and twos, three on one side of hand and foot, and two on the other. This is suggestive of a bird, and especially of the woodpeckers, where, however, there are but four toes altogether, grouped in twos. The independently moving eyes above the grinning mouth are weird in the extreme and not reptile-like ; they are indeed like nothing except a human being with an inordinate squint, and like the eyes of such a being they move independently. Then too the tongue, nearly as long as the body of its possessor when fully extruded, is an extraordinary organ, unparalleled in the reptilian series and only partially paralleled by the ant-bear, the woodpecker and the echidna. The chamæleon when it detects its prey, an insect for choice, literally "gives tongue" to the extent of six inches or so. To watch a chamæleon shows that profound mental differences accompany these structural differences from the remaining crowd of lizards. Its movements are characterized by an almost judicial deliberation. It is elephantine in its slowness. The reptile is in fact not by any means unlike in these particulars to its fellow-dweller upon tree-tops—the American sloth. Finally, the lean and really emaciated form of the chamæleon mark it out as something greatly different from the ordinary run of lizards, who are plump in comparison. This leanness, however, has its uses. The chamæleon has, somewhat rashly for so small a creature, an ungovernable temper ; it literally swells with anger, grunts, bites and flashes changes of colour.

CHAMÆLEON

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If all this fails and the enemy is not to be daunted by bluff, the chamæleon relies upon its scragginess in this way. Its lean sides, like those of a tiger, can by contraction of the muscles lying between the ribs become still more attenuated. This accomplished, the chamæleon prudently, but in another sense to the usual one, turns its back upon its foe, and remains perfectly quiet. The leanness reduces its dimensions to those of a straight line, which has no breadth, and seen in profile, the chamæleon escapes unwelcome attention. Viewed internally, the chamæleon is quite as different from its Lacertilian relatives as it is externally. The most prominent feature revealed by the dissecting knife is the curious tags or blind outgrowths of the lungs, which spread through the body and permit the animal to " visibly swell," as has been already pointed out, when its emotions are roused. That the lungs should have these connected sacs, which do not perform a respiratory function at all, for they have no blood-vessels, is a point of approximation to the air sacs of birds ; and constantly in considering the structure of reptiles do we come across points of resemblance to their really near, but apparently so widely different, fellow-countrymen the birds. We have spoken hitherto of the chamæleon ; but in truth, there are very many different kinds of chamæleons, though the remarks made in the foregoing lines apply, with the exception of a few points, to all of them. There are at least sixty species of chamæleons which exist only in the Old World, and in that hemisphere live mostly in Africa and Madagascar.

As they have all the same kind of habits the differences between the various species are not very striking, except for a half a dozen or so of species which belong to two separate genera known as *Brookesia* and *Rhampholeon*, which have the merest stumpy apology for a tail. The difference is quite analogous to the long and prehensile

tailed monkeys of the New World and to the tailless or stumpy tailed forms among the monkeys of the Old World. But in the case of the chamæleons all are Old World. Male and female chamæleons often show external differences, some of which are quaint and exaggerated. The common chamæleon, which is African, and just extends into Europe and Asia Minor, shows the slightest difference of this kind ; in the male, the casque, as we may term the posterior projecting end of the head, is longer than in the female. Several species, appropriately named "*Calcarifer*" and "*Calcaratus*" on this very account, have a kind of spur on the hind legs just above the ankle, which spurs are again peculiar to the males. But the most extraordinary difference of the kind is to be seen in a few forms, of which a species found high up at an altitude of 6,000 feet on Mount Ruwenzori, in tropical Africa, forms an example. This chamæleon, which was named after Sir Harry Johnston, presents us with three long horns upon the forehead, which give to this reptile a most truculent aspect. Another species from the same mountain has in front of the nose a forwardly directed bony outgrowth. No chamæleons are very large. *Brookesia* and *Rhampholeon*, just alluded to, are quite tiny, three inches or so. So, too, is the "dwarf chamæleon," a South African species, characterized by its green colour and by a patch on the side of a beautiful brick red. On the other hand, the giant of the tribe, *Chamæleon parsoni*, is a couple of feet or so in length.

The Monitor of the Nile

Varanus niloticus is the full-dress name of a large lizard whose habitat is indicated by its name, but which also strays into other parts of Africa. It is one of a genus of lizards entirely confined to the Old World, which has been variously termed *Monitor*, *Varanus*, *Regenia*,

Hydrosaurus, and some few other appellations, but which are all of the same genus ; this genus forms a family all to itself, occupying a very isolated position in the lizard series. To the casual eye, however, uninstructed in the technicalities of zoology, the monitor is a very average-looking lizard, distinguishable chiefly by its greater size, and by its rather long neck. But there is a good deal more in the monitor than meets the eye of the mere observer. Recourse must be had to the scalpel to emphasize the divergences of the monitor from other lizards. It will be readily understood without a comprehensive knowledge of zoology, that it stands on a higher plane than most of its relatives by reason of the more complicated structure of the lungs ; for this added complexity means more efficient breathing and thus better aeration of the blood, and the effects may be felt in every part of the body. A long neck, too, is evidence of advance, for the lower creatures, frogs, fish, and most lizards, are quite apoplectic as to neck, and as a consequence their hearts are in their throats. The heart of *Varanus* is placed farther back, and it is thus more like the higher animals, such as birds and mammals. But these details are mentioned in order to illustrate the fact that it is rash in zoology to judge entirely by external appearance ; they show that two creatures much alike to outward view, may be profoundly different in reality. There are about thirty-four or -five different species of monitors, of which we figure here, *V. gouldi ;* the largest is not the lizard of the Nile, but a huger beast—even seven feet in length—which inhabits certain parts of tropical Asia, and whose name is *Varanus salvator*. Most of these creatures are of a " subfusc " hue, but get brighter in certain places, an added yellowness being the chief alteration. There is certainly one form which is variegated by bright green. Being ground-living creatures, also addicted to water, the dusky hues are more

useful to them than greater brilliancy of colour. They are all of them fiercely carnivorous, and they do not despise carrion ; even the remains of mortals who have undergone tree " burial " in the East are apt to be devoured, while small mammals and other creeping things are readily eaten. The monitor of the Nile is particularly

MONITOR LIZARD.

fond of crocodiles' eggs. The examples at the Zoo are often given eggs, which they swallow cleverly without breaking the shell and spilling the contents. For the name monitor several explanations have been given ; the one most in favour is perhaps that it is due to a misunderstanding of the Arabic word for the lizard. Another is, that it gives notice of the approach of a crocodile. In connexion with this legend, it is remarkable that the

same idea has fixed itself to quite another kind of lizard, inhabiting South America. This lizard, formerly placed in the near neighbourhood of the monitor, is known as the Teguexin, and is referred to on another page. Both ilzards have got the reputation, apparently entirely undeserved, of being a friend to the human race, by giving notice of a prowling alligator. It would be interesting to know whether the idea was conveyed to the natives of South America by white men acquainted with the Old World monitor and its reputation, or whether it is part of an original stock of legends carried from the east to the west or *vice versa* by migrating tribes, who colonized the one half of the world from the other.

The Iguana Lizard

The whole family of lizards to which Iguana belongs are, with a very few exceptions, American in range, and they are for the far greater part denizens of the central and southern parts of that continent, and of the adjacent West Indies, which, zoologically considered, are part of America. The family is a very large one ; but the genus *Iguana* itself, which has given the name to the family, is a very small one, and, indeed, consists of at most three different species. The one most familiar to those visiting the Zoo is undoubtedly *Iguana tuberculata*, which is green in colour, diversified with brown in part, and has an extremely long and, at the end, thin tail. Along the head are a series of tooth-like crests, and under the chin hangs a dewlap like that of an Indian zebu. The iguana lives in trees ; and this habit of living at some altitude seems to beget thoughtfulness, which takes the form in our specimens at the Zoo of extreme immobility. For hours—perhaps if we were there to see we should find it to be days—the iguana sits and does nothing. It is a lizard that has, for a lizard, the uncommon habit of being vegetarian. There are others which share this mode

of life ; but vegetarianism in reptiles is not at all common. The crests along the back and the general attitude of the iguana, evidently suggested to the late Mr. Waterhouse Hawkins the pose for the Iguanodon in the grounds of the Crystal Palace. That extinct creature—an idea of which can be better gained by an inspection of a plaster cast, now on view in the Natural History Museum at South Kensington, of one of the magnificent Bernissart iguanodons in the Museum at Brussels—was named by a certain likeness which its teeth show to that of the iguana, a likeness very possibly to be accounted for by the fact that both are, or were, vegetable-feeding reptiles. However, our iguana has nothing whatever to do with its semi-namesake. It is a true lizard and not a Dinosaur as is the Iguanodon. This lizard grows to several feet in length, of which the tail forms a considerable proportion. Being a plant eater, its flesh is succulent and sought after, and is said to taste like chicken. It is hunted with dogs, before whose keen noses the protective colours of the iguana are useless to it. The common iguana occasionally varies from the typical appearance, and some of the scales upon the nose grow out into horny excrescences. " Rhinolopha " is the appropriate name given to this variety which is, however, not a variety in the sense that is it a distinct form unconnected by intermediate grades with the typical *Iguana tuberculata*. Every intermediate condition occurs, and thus we see that there can be no question of two species. The iguana of Santa Lucia in the West Indies (referred to a different genus) grows to five or six feet in length, and appears to be of a brighter green when young than when full grown, a fact which is in accord with the greater need for protection of the young against their many foes. The full grown iguana is by no means an easy prey to those creatures which attack it, and the late Mr. P. H. Gosse observed of it that it " directs its eye to the object

of attack with a peculiar sinister look"; the sinister character of this offensive gaze seems to be due to the fact that the reptile does not move its eyes at all, but turns its head with decision and deliberation towards

IGUANA LIZARD.

the foe, following his movements with a fiercely prepared aspect. When it does attack the attack is often made with the tail, the serrated crest of which causes it to cut like a saw. Arboreal though the iguana is for the greater part of its days, it does occasionally leave its tree. This occurs especially during the breeding season, when the

iguana deposits its eggs in the sand of the seashore in such localities as enable it to reach the sea. Oddly enough it is said that though the iguana can swim with ease, it objects to sea water, which, in view of the locality chosen by it for egg laying, is curious. An ally of the iguana, the marine lizard, *Oreocephalus* of the Galapagos, does not share this distaste for sea water ; it is an interesting fact that even iguanas can be submerged for a long time in water without being drowned ; and it will be remembered that Darwin tried, and in vain, to drown an *Oreocephalus*. The dewlap under its chin is not an inflatable structure, as some have thought or at least asserted ; but a very near ally of *Iguana*, known as *Metopoceros cornutus*, has a really dilatable throat pouch with which to express anger and perhaps also convey terror. This last iguana is black where our iguana is green ; and yet it is also arboreal.

An Ancient Lizard

For hours together this reptile will sit like Saturn, " quiet as a stone," with hardly a blink of eyelid to indicate that it is not intended, like the chamois of Mark Twain, to fulfil obligations towards the visitor. The quiet atttude is not, however, an attribute of *Sphenodon* (or *Hatteria*) *punctata* only. It is common to the reptile tribe who live often two lives in sharp contrast. At times the eye can hardly follow the brisk movements of a small lizard ; at other times it is as if carved or stuffed. The tuatera presents no features which mark it out to the uninstructed eye as anything unlike the average of lizards. And, indeed, if all we had to judge by were external form and habits, *Hatteria* would be most unquestionably relegated without doubt to the Lacertilia. It has blackish olive hues, which are not unknown in the lizard tribe. The close-set crest along the back is to be seen in the *iguana ;* even the " parietal eye," so con-

spicuous in this animal as a clear mark on the top of the skull, is equally well shown in *Iguana*. There is nothing odd about the limbs or the tail. In short it is not surprising that, until its interior arrangements were made out, the *Hatteria* was considered to be, what it certainly is not, a quite typical lizard. The fact is, that if we are to use the term lizard, that word must be decidedly put into inverted commas, as a token that its use is a concession to popular language. As a matter of fact there is no vernacular word which will express just exactly what the *Hatteria* is. Zoologists regard it as an early offshoot from the stem which produced not only lizards and snakes, but possibly, also, some other now existing types of reptiles. But we cannot call it either a pro-Lacertilian or a pro-reptile, though to the mind of the present writer it is mostly Lacertilian. We must content ourselves with calling it for the present simply by its name. The bony characters which distinguish *Hatteria* from lizards pervade the whole skeleton, and would require a little too much technical exposition for their due setting forth. But everyone can appreciate the fact that the lungs have not yet undergone the modifications that they have in the true lizards and snakes. In the lizards, and much more in the snakes, the end of the lung farthest away from the entrance of the windpipe into it has partly or entirely ceased to have a respiratory function. Its walls are here thin and not so markedly honeycombed in structure as is the rest of the lung. Furthermore, in very many lizards the lung is completely or partially divided into two or more compartments. In *Hatteria* the lung is an efficient lung throughout, and is a simple undivided sac. We are acquainted with a good many extinct relatives of *Hatteria* which carry us back to very early geological times. Its allies then flourished in Europe and in other parts of the world. Now the sphenodon is confined not only to New Zealand

but to certain small islands off the main islands. They are particularly common apparently in Stephen's island, where their breeding habits have been observed. At the Zoo they have been given every chance to let us into these mysteries, but without avail. The reptile lays eggs in a burrow which it inhabits in perfect amity with

HATTERIA LIZARD.

various birds, like several other burrowing animals that we deal with in this book, such as the American prairie dog and vizcacha. In these burrows it deposits its eggs, carrying them in in its mouth after actually "laying" them outside. Why this elaboration of instinct should have been evolved does not seem easy of explanation.

The young when they leave the egg are not coloured like their parents, a common occurrence among animals; they also illustrate another common feature in the coloration of young creatures, which is that they are striped. The young pig and the young tapir are other examples of this same phenomenon. And it has been attempted to be proved by these and other causes, that animals in the course of their development go through a regular series of colour changes which are necessary accompaniments of that evolution. The tuatera can bite, and that effectively, since it possesses what few lizards do, an additional set of teeth upon the palatine bones which form part of the roof of the mouth, additional, that is to say, to those upon the upper and lower jaws. Its native name of tuatera seems to mean "possessing spines," and refers to its crest.

Snakes: the Order Ophidia.

Although the limbless lizards, such as the blind-worm and the European scheltopusik (*Ophisaurus apus*), dealt with on a previous page, run the snakes rather close in outward appearance, it is really not difficult to distinguish by external appearance and behaviour the Ophidia from the Lacertilia. The limbless, and so far, snake-like lizard has a milder look than the true snake, whose relentless and unwinking eyes produce even in the harmless kinds that feeling of repulsion which is apt to be felt for the serpent. The mildness of the lizard is due to the fact that it has movable eyelids, while the eyes of the snake have no such eyelids, but are covered with a single and transparent scale; this is removed when the snake sheds its skin and comes off with it in the form of a watch glass. That the geckos have not for the most part eyelids does not lead to any confusion, for the blind-worms which offer the most difficulties have. The movements of the legless lizards have not that finished ease which

attends the gliding of the snake. The former suggest forcibly that they want practice in the art of walking without limbs. When the snake feeds it engulphs its food in a way totally different to that of the lizard. The two halves of the lower jaw, instead of being bound together by solid bony union, as in the lizards, for the most part, are only connected by softish ligament, and thus can be stretched and allow their possessor to manage a very big morsel. The lizards are compelled to exercise greater moderation in the size of their prey. Were a python a lizard, it would have to be content with rats instead of being able to get outside a goat. A flickering bifid tongue is a character of the snakes, and though it is found in lizards it is not by any means universal in that group. For the rest, snakes have, like lizards, the same alternation between extreme alertness and sluggish laziness. Snakes are entirely animal feeders and devour living prey, with the exception of two egg-eating snakes, of which one, the African *Dasypeltis scabra*, is often to be seen at the Zoo. Lizards vary their diet more, and they not only eat living prey and eggs, but also are in the case of some species, vegetarians. When we come to internal characters there are more means of distinguishing between the two orders. The principal one, and it is one that is not usually so much dwelt upon in books contrasting the anatomy of the two groups, is seen in the way in which the internal organs are packed in the body. In all lizards the stomach, intestines, liver, and so forth, lie in a spacious cavity known to anatomists as the cœlom. In snakes the cœlom is still there; but, instead of forming one large cavity, with plenty of room for more organs than already lie in it, it is divided up into a series of more restricted cavities, in each of which lies some special organ. Thus, the long and narrow liver is enveloped in two sacs meeting in its middle line and showing incidentally that the apparently single-

lobed liver is really made up of two lobes, though they are closely adpressed. In the same way other organs are contained in other compartments. The lizards' body cavity and viscera suggest a scantily filled and loosely packed portmanteau ; that of the lizard a full and closely packed box.

Snakes are quite as numerous as lizards, and have much the same range ; they are, like the lizards, particularly abundant in the tropics. Iceland, as we all know, has no snakes, and generally speaking, as with lizards, they wane in numbers towards the north. The three British snakes, viz. the grass snake (*Tropidonotus natrix*), the smooth snake (*Coronella austriaca*), and the viper (*Vipera berus*), are almost, if not quite, always on view at the Zoo. As with lizards, there are terrestrial, arboreal, aquatic, and even marine snakes. But the marine snakes are much more marine than is the iguanoid lizard, *Oreocephalus*, which lives largely in the sea off the Galapagos. Such genera as *Distira*, *Hydrus*, *Platyurus*, are, with a few exceptions, purely marine and pelagic, living at the surface of the ocean and preying upon fish. These snakes are hardly likely, from the nature of the case, to be seen at the Zoo. Besides these marine snakes a large number of serpents of various kinds spend a large part of their time in freshwater ponds, ditches, etc. For example, the North American water viper (*Ancistrodon piscivorus*), and even the common grass snake. At the opposite extreme is the desert-haunting Cleopatra's asp (*Cerastes cornuta*), with the projecting and horn-like scale above each eye. Though whether the Egyptian queen did not avail herself of the African cobra (*Naia haje*) is a moot question. These desert snakes are, like the desert-loving lizards and mammals, and even birds, clad in desert colours. Arboreal snakes are exemplified by the boas, and by such types as the green viper, dealt with later. There are

also harmless and green snakes, which frequent trees. Snakes are divisible into a considerable series of families. The most important of these are the Boidæ, the Colubridæ and the Viperidæ. The Boidæ are, as the names suggests, the *Boa constrictor* and its allies, the pythons, anaconda, and the European and Old World genus, *Eryx*, besides some less known forms.

The greatest interest attaching to these snakes is that they stand at the base of the Ophidian series ; they have not so completely lost the characteristics of the more lizard-like form from which snakes, as we think, must have been derived. For they possess what no snakes, except certain immediate allies of their own, belonging however to other families, possess, distinct rudiments of the hind limbs, which are even visible externally, as a small claw on either side of the vent. They have also two lungs, whereas in the more modified snakes the lungs have dwindled down to a single one and, at the most, a tiny rudiment of the other. This reduction of the lungs is also seen in the limbless lizards, but it is not so fully carried out in all of them as it is in the modified vipers among snakes. Otherwise the pythons and boas are typical snakes to all outward appearance, and have no essential peculiarities externally, which mark them off as something distinct from other snakes, save only the hooks already mentioned. Allied to the Boidæ are several families of small and burrowing snakes, such as the Typhlopidæ, Ilysiidæ, and Uropeltidæ, of which representatives are not, as a rule, to be seen at the Zoological Gardens.

The Colubridæ, or Colubrine snakes embrace the vast majority of species of the snake tribe, and the family includes some of the most deadly of their kind. People used to group together the venomous as opposed to the non-venomous serpents ; but it is now seen that this physiological attribute is not sufficient to outweigh real

anatomical distinctions between various snakes. So that the poisonous vipers are not nowadays placed with poisonous cobras. These Colubridæ, which are poisonous, are usually grouped together into two series, named in accordance with the fact that the poison fangs are anterior or posterior. In the "Proteroglypha" it is some of the anterior teeth in the upper jaw which are grooved and transmit the deadly venom. In the "Opisthoglypha" it is on the contrary, the posterior. The fangs of the viper are dealt with under the description of the tree viper below. The essential difference between the venomous colubrine and the venomous viper is the reduction of the poison fangs, and the maxillary bone which bears them, in the latter, and the fact that the teeth are not merely grooved for the transmission of the ducts of the salivary glands which secrete the poison, but actually perforated at the base as well as grooved further up.

The Sucuruju or Anaconda

The first of the two above names is the best one to use for this, the largest of the snake tribe. For it is actually an "Indian" word in use in South America, whereas anaconda is apparently Ceylonese in origin. Another vernacular name is Water Camoodie, in contrast to Camoodie, which refers in British Guiana to the boas, including the well-known *Boa constrictor*. *Eunectes murinus* is the technical name of the best known species of anaconda, for of these snakes there are more than one kind. They inhabit only tropical South America, and would seem to be undoubtedly the largest living serpent. Thirty-three feet has been registered, and others say thirty-seven, or even over forty. But skins will stretch and imaginations also. Still it is big, and its size may be the cause, taken into conjunction with its habitat, of part of the sea-serpent legends. There seems to be

every probability that this mythical beast is compounded of many elements. The sucuruju is both aquatic and arboreal, so that its chances of being washed out to sea in an unusual spate are more than those of some other large snakes. Given an unusually large anaconda and a mariner cheered by a double allowance of grog, twilight and a stormy sea, and we have a good sea-serpent basis at once. The anaconda (after all, "sucuruju" is a tiresome word to say and to spell) grows very thick; and its head, which is large, is divided from its body by a slender neck, instead of running into it as in the European allies of the anaconda, the snakes called *Eryx*. It may seem absurd to say that this serpent has a particularly short tail; for serpents seem to be either all neck or all tail. But as a matter of fact, on the whole serpents differ from lizards by the fact that they have a short tail, while lizards have a long one. The tail is marked in the anaconda by a pair of short recurved claws, which, with some adjacent bonelets, are the remains of the hind pair of limbs present also in all the pythons and other immediate allies of the anaconda, but absent in other snakes, such as the vipers and colubrines. The colour of this serpent is olive brown, with black marks along the back. Like the great pythons of Asia and Africa, the anaconda often, especially just after it has shed its skin, and gotten a new one—shows beautiful iridescent hues. It brings forth its young alive, as do the vipers. The anaconda is one of the "constricting" snakes, that is, it crushes the life out of its prey by winding round it before proceeding to eat it. Much has been written about the deadly fascination exercised by this and other snakes upon their intended prey, which have been said to approach gradually to their foe, allured by its brilliant eyes and steady stare. As a matter of fact these legends of fascination appear to be based upon two facts. Firstly, the flickering

tongue of the snake, so constant in its motions, naturally attracts, as would any moving object, the attention of small creatures suitable for food. Secondly, a state of catalepsy, due to nervous shock and terror, is a common event in the lives of various creatures. It is not the fascination of the snake, but an overpowering sense of dread that overcomes the bird or mammal upon which the anaconda is steadily advancing. Another legend concerning the snake is, that it lubricates its prey before swallowing it. This is sheer invention. The actual swallowing takes place without any such lubrication, which indeed, with the small salivary glands at the disposal of the snake, would be impossible. But it occasionally happens that after swallowing, the object swallowed is disgorged by fear or other emotion. Then it emerges into the daylight, covered of course with the viscid secretions of the œsophagus or stomach, a circumstance which may readily have given rise to the commonly held view. The anaconda feeds principally upon reptiles, fishes, and mammals—in fact, upon anything that comes handy. A catholic taste in meat is the prevailing fashion among snakes, there being but rare exceptions, such as the egg-eating snake of Africa, *Dasypeltis scabra*. Its habit of lurking in or by streams, is well suited to its tastes ; for all mammals must come and drink at times. The murky backwaters of South America do not lend themselves to clear vision ; and it is therefore not surprising to learn that in the anaconda the sense of sight does not help it so much in detecting its prey as the sense of hearing and then touch. It is said that when rats are introduced into a cage containing this serpent it does not begin to " take notice " until the rats begin to squeak. Their dolorous notes arouse the attention of the snake ; it pricks up its ears so to say, and on the first contact with the exploring rodents winds its deadly coil round them. Like the

famous snapping-turtle of the Bongaultier ballads, the anaconda eats alligators. That this is an actual habit of the snake was discovered, to his cost, by a German gentleman, who purchased examples of both and left them together through stress of accommodation. To tackle an alligator, even for an anaconda, is a serious matter. Mr. Quelch relates that a fight between the two reptiles, ending in victory for the snake, took two days. It all depends, as with wrestlers, upon the way in which the snake succeeds in laying hold of the alligator. When in an advantageous position from the snake's point of view, victory is assured. Besides alligators, the anaconda devours teguexin lizards, for which it appears to have a partiality; it has been known to swallow such large beasts as peccaries and wood deer. Oddly enough, its specific name of "*murinus*" has been given to it on account of the fact that its small young eat mice. It is a moot point whether the anaconda will attack human beings. There is a general belief that it will do so, and a consequent dread of the Ophidian in many parts of South America. And there are cases of anacondas having seized hold of a human being. A boy washing rice in a stream was laid hold of by one of these snakes but liberated by his father. In this case it is thought that the mere movement of the water led the snake to the wrong impression that some convenient fish was in the neighbourhood. So bathing where there are anacondas is not certainly dangerous, though an accidental nip would not be a pleasant thing to occur, and is rather uncanny to contemplate. Naturally, the anaconda has given rise to legend. Anything big always does. Along the Amazons Mr. Bates relates that this serpent is the origin of a legend of a huge freshwater sea-serpent, to speak Hibernically, named *Mai d'Agoa*, mother or spirit of the water. There is also the Minhocao, an equally fabulous beast who tunnels the mud

and overthrows trees as they stand in its path. But this creature has probably grown out of an æstivating Lediposiren, or even, as some say, an unusually large earthworm! There are always, or nearly always, anacondas at the Zoo, and those of fair proportions.

The King Cobra or Hamadryad

Rather lurid in colour and very ferocious in habit is this, the largest of all poisonous serpents. It is a native of the torrid East, and extends pretty well all the way from India to Sumatra. Considering its conspicuous size, it is not a little odd that it should have been first made known to science so recently as the year 1837, when Dr. Cantor described it. But the visitor to the Reptile House will soon gather why this long and venomous snake should have been overlooked. It is really extremely like a cobra, as indeed its vernacular name or, better, one of its many vernacular names, suggests. The same smallish head with clear scaling, brownish to blackish hues, elegant and tapering body, that are seen in the cobra mark the hamadryad. There is even a legend that the earliest representative of this species to reach the Zoological Gardens was inadvertently placed in a case with a family of cobras, and that being hungry after a long voyage it ate up £50 worth before its full identity was thoroughly established. Anyhow, the hamadryad bears a great superficial likeness to the spectacled cobra, so great a likeness, indeed, that some systematists, influenced entirely by superficialities, as systematic zoologists are unfortunately apt to be, have bracketed it with the cobra in the same genus, *Naia*. More far-seeing was Dr. Cantor, who separated it, a conclusion which recent investigations into its internal arrangements, particularly the structure of the windpipe, have fully justified. 1837 was the year which wit-

nessed the first disentangling of the hamadryad from the cobra as a distinct serpent. It was not until 1875 that the first live specimen ever reached Europe. This individual arrived at the Zoological Gardens in that year, and survived for no less than twelve years. From that time to the present there have been many, and some of them large ones. Length in a serpent is a matter which is apt to be exaggerated. The one thing which a serpent has got to be is to be long. But with all the stretching in the world the hamadryad cannot be pulled out to more than fifteen feet, and twelve feet is perhaps a better estimate of its extreme length. With misleading pedantry the British Museum catalogue of snakes calls it 3,900 *millimetres!* No creature that is not enclosed in a hard box like a tortoise or an insect can be measured with such absolute accuracy. The colour above is brown to black, with a whitish belly, and in young examples there are yellow bands. It has been pointed out in the case of the cobra that legend has it that the blacker specimens are the more ferocious. Melanism, or a darkening of normal hues, is a not uncommon phenomenon in the animal world; but to associate it with a correspondingly increased fierceness is perhaps making the creature out to be blacker than Nature has painted it. Nevertheless, we learn from the poet that the dark-coloured South is "fierce and fickle."

The name hamadryad is plainly to be derived from the tree-frequenting habits of *Ophiophagus bungarus*, as the full scientific name runs. From this "bad eminence" the serpent is said to look out for a coolie, and then to descend upon him in an unexpected shower of writhing coils. Exaggeration apart, it does seem to be proved that during the breeding season, that time of fierce irritability in many beasts and birds, the hamadryad is more apt to lose its temper, and to

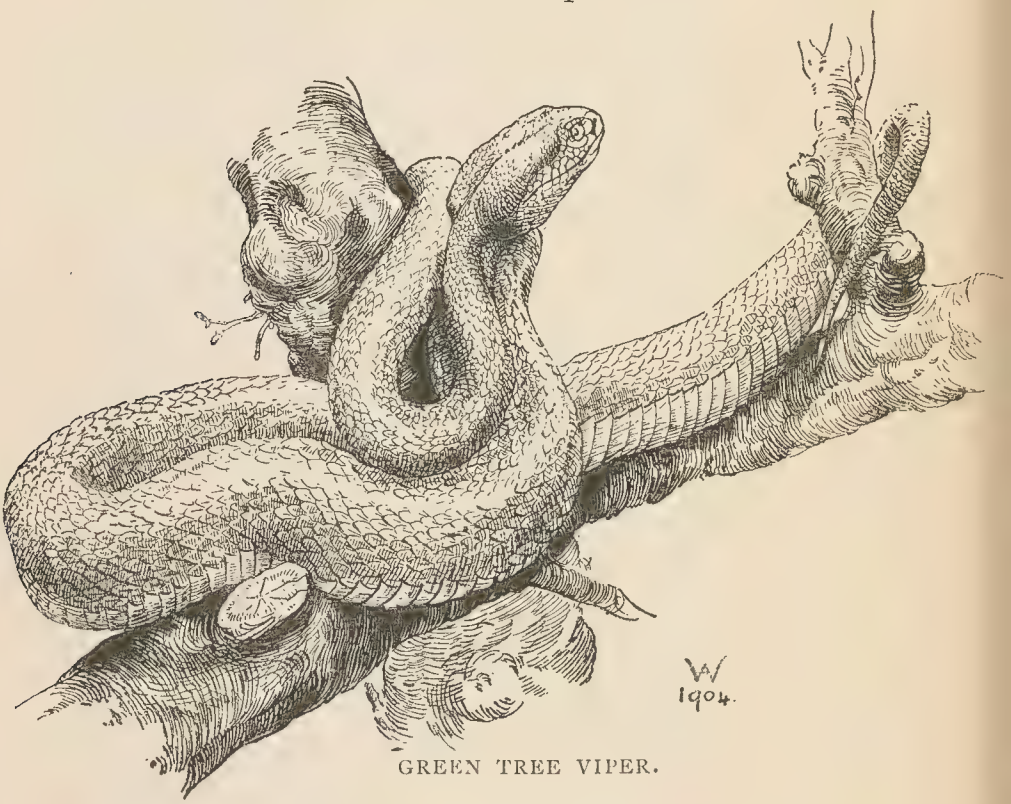
attack with little or no provocation. The second of the better known "popular" names, i.e. King Cobra, is a name which has possibly been referred to the hamadryad from the cobra itself. Legend again—in snake natural history there is much that is legendary—to use a non-provocative expression, relates that a large snake was observed to utter a peculiar note, and that from neighbouring thickets out came a crowd of smaller snakes, who prostrated themselves before the monarch; he, however, selected a fat one for immediate consumption. But there is this basis of truth recorded in the scientific name—that the *Ophiophagus* is a snake-eater by choice; specimens at the Zoo are fed upon common English grass snakes, which they eat almost after the fashion of an Englishman devouring a stick of asparagus.

The older naturalists put together all the poisonous snakes, and separated them from the harmless varieties, and in this way associated the vipers and the cobras. But we now know that one set of poisonous snakes is not very nearly related to the other. In the vipers the poison teeth have the characters that we have already dealt with, and which we need not therefore recapitulate. In this snake the hinder series of teeth are merely grooved, and the poison pours along all or any of them with indifference to reach the wound which they have made,

The Green Tree Viper

The snake is apt to be as wily nowadays as he was in the Garden of Eden some time since; but his guile takes a different form. The aim of the modern serpent is the honest and straightforward one of securing as much food as possible, and of escaping his enemies. In order to accomplish these two aims resource is had to varied forms of deception. Sheer strength, and even the possession of formidable fangs with poison

bags attached, is not enough to ensure success in life for any of the punier snakes of to-day. We find therefore, a variety of ways in which these creatures confront their foes in the struggle for existence. The viper in question, *Lachesis gramineus*, is certainly one of, if not *the* most beautiful serpent in existence. Its



GREEN TREE VIPER.

whole body is of an exquisite grassy green; its proportions are elegant, and the diamond-shaped head, so characteristic of vipers, only adds to the gracefulness of its outline. It has avoided the coarse puffiness of the rattlesnake and the somewhat scraggy proportions of the British viper. Like all vipers, it is provided with one or two fangs on each side of the upper jaw, which are replaced by others when they are worn out or dropped; and, as in other vipers, these teeth are tubes leading from the duct of the poison

gland to the wound which their sharp end has made in some hostile or edible creature. The reduction of the poison fangs and their tubular, not merely grooved, structure is a mark of the viperine dentition. Moreover, this particular viper has a little pit on the side of the face, as has the rattlesnake, from which character it is known as a pit viper, a distinction from the common viper of this country and its allies, which are perfect as vipers, but have no pit. This snake haunts the leafy branches of trees, and, as we suppose, in accordance with that habit, its uniform hue hides it when motionless. This same shade of green is not uncommon among reptiles. It is to be seen, for example, in the European green lizard, and in a very beautiful gecko from Madagascar, which has the name of *Phelsuma madagascariensis*, in various chamæleons, and in other forms. The green is of the same timbre in all of them. This little viper is therefore doubly armed to hold its own. It can escape observation by its harmonious colouring, harmonious, that is to say, with leafy or grassy surroundings, and it can give a thoroughly good account of itself if detected.

Order Chelonia

The tortoises and turtles form an assemblage about the limits of which there can be no possible mistake. They are encased more or less completely in a bony box, which is generally overlaid by epidermic scales, quite comparable with those of lizards. The bony box is produced by ossifications within the skin, and has, of course, nothing to do with the skeleton proper, although its bones are often fused with bones of the true skeleton. The Chelonia also have toothless jaws, the want of teeth being to some extent compensated by the existence of a horny sheath to the jaws, which is exactly comparable to the bird's beak.

It is to be noticed, however, that the skin skeleton of the tortoise tribe is not absolutely *sui generis*. In detail, of course, nothing like it is found in any other reptile at present known. But the dorsal part of the box or carapace is, of course, to be compared with the dorsal bony skin shields of crocodiles, while the same comparison holds good with regard to the ventral plastron, which is, moreover, comparable to the thin ossifications found on the ventral surface of *Hatteria*, and in that reptile termed abdominal ribs. Toothlessness happens not to be an attribute of any living group of reptiles except the Chelonia ; but there are extinct families, though not orders, which are in the same way without teeth. Here, as elsewhere in Nature, hard and fast lines of demarcation do not exist. The selection of tortoises at the Zoo is a considerable one at any time.

Testudo Daudini

This tortoise is actually the largest living representative of the giant tortoises of the world. Large tortoises do not differ from small ones, such as the *Testudo græca* of southern Europe, and of our streets in London at certain times. That is to say, they are anatomically not separable, though vastly exceeding them in size, and also characterized by a varying number of small external and other features, which allow us to place the large tortoises in several species. At present we only find very large tortoises on small islands. It is hardly an exaggeration to say that the smaller the island the larger are its tortoises. This is very unexpected, because, among the mammalia at any rate, beasts seem to require a spacious environment to attain to any bulk. Madagascar, for example, has small mammals, while in the forests of the neigh-

bouring continent of Africa range the elephant and the rhinoceros. The Indian elephant and the Indian species of rhinoceros do not flourish in the smaller islands of the Eastern Archipelago. With the tortoises it is otherwise. The Mascarene islands and the Galapagos Archipelago are the spots haunted by the biggest existing tortoises, of which the species *T. daudini*, from the south island of Aldabra, has furnished us with the largest living tortoise; that specimen was until recently alive at the Zoo. The puzzle as to how they got upon these islands is like that of the flies in amber or the apples in the dumpling. We can only infer, and inference has been of two kinds. It has been held that the Mascarene islands and the Galapagos are the last vestiges of submerged continents, from which other inhabitants have dwindled away in correspondence with the shrinking of *terra firma;* only the tortoises remained, and finding the locality congenial and competition scarce, they waxed fat and grew in bulk. Viewed in this way the presence of these giants is a clue to formerly existing continents. On the other hand, it is not so certain that they may not have reached the islands, when they *were* islands, by sea transit. Heavy though the colossal tortoises of the Galapagos are, they will breast the waves of the pond in their enclosure with some success, and float in quite a feathery fashion upon its bosom. If one tortoise, heavy with eggs, were safely piloted across the waves, a colony would be formed, and this event repeated once a century would account for all the facts. The success when once arrived at is not difficult of understanding; it is the mode of arrival which puzzles us. The great *Testudo daudini*, once at the Zoo, and to which reference has been made, measured fifty-five inches along the shell. To this has to be added something for length of neck, and some of these big tor-

toises, like the smaller ones, can crane their necks to the extent of a good many inches. This particular beast forms an excellent instance of the longevity of cold-blooded tortoises. At first sight there seems to be no particular reason why they should not be positively immortal. They can reduce breathing, feeding, and the other necessities of life to their lowest terms, and thus exist torpidly for months together. Why should they not husband out life's taper indefinitely? It was asserted to be at any rate 150 years old, and observations have been made upon other species and specimens, tending to prove the fact that they can survive for many years. The word Galapagos is good Castilian for tortoise, and is analogous to Robben Island, so named on account of its sea lions, and Puffin Island on our own coasts. It was there that Darwin rode triumphantly upon a great reptile, though the task is not so easy as might seem, for, in spite of its apparent lethargy, the animal can perform the testudinian equivalent of shrugging its shoulders, and one is apt to be dislodged in the process. All these tortoises, however, pale their ineffectual fires before a great fossil of the Siwalik hills, described to the Zoological Society in 1844 by Dr. Falconer and Capt. Cautley. *Colossochelys atlas*, appropriately so named, had a carapace of over twelve feet in length, according to the estimate from its fragmentary remains. This tortoise, according to Indian cosmogony, sustained an elephant, and that elephant in its turn the world. That it could have sustained an elephant upon its broad back is quite probable. These legends seem to show that the tortoise, or one like it, lived down to human times. In any case, the remains of extinct and giant tortoises are found in many places, but the only living giants come from the localities which we have mentioned.

FLIPPERS OF TURTLE

The Green Turtle

The turtle, i.e. that of the Atlantic Ocean and of aldermen, of green fat and of tortoiseshell, has been from time to time on view at the Zoo. Indeed, fairly big specimens have been acquired to show to the public. It is not, however, from the nature of the case, a beast which shows great longevity in Regent's Park. This Chelonian, and its immediate allies, are to be distinguished from the land and aquatic tortoises by the fact that the limbs are much more perfect swimming organs. They have acquired the paddle form of the fish fin and of the whale's flipper. In accordance with this they are purely marine, and only go on shore to lay their eggs. Like the testudinidæ, to which they are anatomically most nearly allied, they are vegetable feeders. Like other animals that inhabit the sea, the green turtle is very widely spread. That is a good thing for the banqueting halls of London, but (to quote a writer of some sixty years since) "it would be quite superfluous to descant on the enthusiastic veneration in which turtle soup is held by our wealthy and discerning fellow-citizens." It may, however, be permissible to point out that turtle is a modern luxury. In the year 1754, on "Saturday, July 13, the Right Hon. the Lord Anson made a present to the gentlemen of White's Chocolate House of a turtle which weighed 300 pounds weight." And again, in 1753, there occurs this paragraph: "Friday, Aug. 31, a turtle weighing 350 pounds was eat at the *King's Arms* Tavern, Pall Mall; the mouth of an oven was taken down to admit the part to be baked." These journalistic notes indicate that turtle was not a very common article of diet with our great-great-grandfathers. Turtles are caught in nets, with harpoons, and by the help of the sucking fish, *Remora*. When the reptiles come to

shore to lay their eggs and are helpless, they are turned over, and then removed at leisure. It is said that the jaguar imitates man in this mode of catching turtles, and that he scoops out the succulent flesh then and there. The product known as "tortoiseshell" has been mentioned. This, as a matter of fact, comes more especially from the near ally of the green turtle, *Chelone midas*, *Ch. imbricata*, the hawk's bill turtle. Although useless for the purposes of Calipash and Calipee, the hawk's bill turtle is much hunted for its tortoiseshell. The pursuit of the turtle for its tortoiseshell is as old as the Egyptians, who traded with the Romans. The substance is, of course, made of the epidermic scales exactly comparable to those of lizards and snakes, which overlie the bony plates of the carapace.

A "Snapping Turtle"

Macroclemmys temminckii may be fairly regarded as the prototype of the celebrated "snapping turtle" of the Bongaultier ballads, finally put to rout by Rufus Daws, and at whose approach alligators bounded up the trees like squirrels. It is, in fact, called the alligator terrapin, though not from its association with the ballad referred to. It is so named by reason of fierce and slightly alligator-like head, by its ridged tail, and by reason of its carnivorous habits. These water tortoises, in fact, are not vegetarians like the testudinidæ of the land. They attack fish, and feed generally upon living animals of such kinds as their bulk and agility will allow them to capture. The difference between this and other water tortoises and the land tortoises is, that the limbs and tail, as well as the head, are too large and stout to be withdrawn into the shelter of the carapace. They are obliged, therefore, to trust

to themselves, and not to their "shell" for protection in the hour of need. The *Testudo græca*, for instance, has only to retire into its shell, and wait patiently until the enemy has rolled by, even if it rolls over the tortoise on its way. The fiercer terrapin can resent any attack by a sharp bite; it has no more teeth than its pond relatives, but the beak is more hooked, and with sharper edges. In spite of its ferocity, and Prof. Louis Agassiz said that these tortoises "are as ferocious as the wildest beast of prey," a large specimen at the Zoo appeared to remain quiescent for weeks together. So quiet indeed was it that a copious growth of green algæ had collected upon its shell. It lay at the bottom, often with its mouth open, in which flickered little tags of skin, which possibly act as an allurement to little fishes to wander in and to meet with their death. Many animals are betrayed by their eyes; the puzzle is in this terrapin to find the eyes at all, for they have an apparently unusual forward position, and are coloured like the skin. A relentless and gazing eye might be supposed to warn off prey; the glittering eyes of a snake, for instance, might be held to be of the nature of a "warning coloration," to small birds and mammals. When urged to "Gouge him, gouge him, darn ye, gouge him," the hero of the snapping turtle incident might have well been unable to comply. It is dangerous to generalize from single cases, and the ancient Greeks, or at least the sculptor Phidias, would not have placed the tortoise at the feet of Venus as the symbol of gentleness had he been acquainted with this martial beast.

Order Crocodilia

The principal features of this Order are described on the following pages.

The Chinese Alligator

Until the year 1870 alligators were believed to be purely New World Crocodilia, though crocodiles were known to extend their range from East to West, indeed from China to Peru. In 1870 this view was partly proved to be inaccurate, and entirely so in 1879, when the Chinese alligator, *Alligator sinensis*, was definitely described from the Yang-tse-Kiang. To the visitor to the Reptile House there will appear to be no great facility for distinguishing Crocodiles from alligators. And yet there are several points in which these two divisions of the existing crocodilia can be observed to differ from each other. The true alligators have the fourth tooth on each side of the lower jaw fitted into a pit in the upper jaw when both are closed, while in the crocodiles this same tooth fits into a notch at the corresponding spot in the upper jaw. Judged by this standard the Chinese crocodilian is unquestionably not a crocodile, but an alligator. The differences which mark this Flowery Land alligator from others of America are but slight, and both crocodiles and alligators are linked so closely together that anatomy is somewhat hard put to it to separate them by any than the most trivial characters; so that the general features of the crocodile tribe can be as well illustrated by the type we have selected as by any other. Otherwise it might have seemed a little perverse to select for the type of this group a creature which is not certainly to be seen by visitors to the Zoo. It has, however, been on view, and very possibly will be again.

The crocodile tribe can hardly be mistaken for any other Saurians. And yet the very name alligator, a corruption of the Spanish Una Lagarta, testifies to the confusion which may spring in the non-zoological mind. That the crocodiles and alligators are confined to water only, leaving their streams and pools

CROCODILLS

To face p. 272]

to bask upon the shore, or to make short excursions in quest of other pools, is not a feature which absolutely differentiates the group from the lizards, for there are many aquatic forms to be found there; but it is a feature which is characteristic of all crocodilians. These reptiles do not follow the lacertilian plan of shedding their skin in conspicuous bits; the wear and tear of the outer covering of the body is like that in ourselves; it is constant and imperceptible. Underneath the scales are bony plates, which are mostly to be found only upon the back, though in the caimans of South America there are ventral scutes, as these armoured plates are termed, in addition to those upon the back. No lizard has so extensive a series of plates of this kind, though there are corresponding, but only slightly developed, plates in some forms. Many of these plates, and the bones of the head also, are irregularly pitted and honeycombed, a characteristic which can be readily seen in crocodiles. The nostrils, it will be noticed, are at the top of the snout, and the animal can lie nearly submerged, with only the nostrils and eyes projecting. An ingenious apparatus, not found in lizards, enables crocodiles and alligators to swallow their prey beneath the surface without running the risk of choking themselves. The internal nostrils open into the throat far back, and a soft downhanging process shuts them off from the proper mouth cavity, which can be thus opened and closed without admitting water into the lungs. In internal anatomy the differences which distinguish this group of reptiles are numerous and profound.

Although the Chinese alligator was not known to Europe forty years ago, the Chinese writers were well acquainted with it, and heaped it round with much legend and mystery. The N'Go or To, as this animal is named, is said to attain to an extremely green old

age ; indeed, its capacity for longevity has given rise to a proverbial expression comparable to Methusaleh or Old Parr among ourselves. The Chinese zoologists, or curiosity-mongers, to use a more descriptive term, variously termed the N'Go a fish, a dragon, and a tortoise. They prized it in medicine, and Marco Polo himself was gravely of opinion that its merits were high ; the gall he recommended as a cure for the bite of a mad dog. But its usefulness is by no means confined to this disease, for, like certain much-advertised drugs among ourselves, there appears to be no ill that Chinese flesh is heir to that the carcass of this beast will not furnish remedies for. As alligators and crocodiles go, this Chinese representative of the family is not large ; it is a dwarf beside the twenty-foot long crocodiles, and still more so when compared with the huge extinct Siwalik crocodilian, which measured fifty feet from snout to end of tail. Of other crocodiles and alligators plenty of examples are certain to be in the Reptile House.

CHAPTER IX

Amphibia and Fishes

THE amphibia, those cold-blooded and reptile-like creatures, really stand midway between the reptiles proper and the underlying fishes. A study even of those characters which can be seen without recourse to the scalpel help in fixing pretty definitely the place of the amphibia in the scheme of Nature. It will be convenient to emphasize the relationships and differences between the amphibia and the reptiles by taking two representative types, one of each, and then comparing them character by character. Later the results can be amended by the consideration of exceptions, so as to apply to the whole group in either case. We may select for our comparison the North American *Menobranchus*, of which there are practically certain to be examples in the Reptile House, and any lizard among the large assortment contained in the same house; let us say either of the common British species, *Lacerta vivipara* or *agilis*. The newt-like amphibian is purely aquatic, while the lizard is as eminently terrestrial, selecting indeed especially the driest of sandy localities. The *Menobranchus* loves coolness and darkness; the lizard rejoices in the day and in warm sunlight. The skin of the menobranch is soft and slimy; not only are there no scales of any kind, but the epidermis is everywhere developed into slime-producing glands, which cover the body with their secretions. In the

lizard the body is dry and hard, the epidermis being converted into regularly arranged scales, while there are no glands in the skin except at the beginning of the thighs, where a row of pores void on to the exterior the secretion of the femoral glands. The limbs of the amphibian are short and only four-toed, not much used in locomotion. Those of the lizard are five-toed and longer, and very much used in locomotion. On the neck of the menobranch will be noticed three pairs of fringed red outgrowths of the body, which are the gills; by means of these the animal at least partially breathes. It has also lungs. Close to the gills are, on each side of the neck, two perforations which lead into the pharynx; these are the so-called gill clefts. In the lizards we find not the slightest trace of these last two structures. The animal has only lungs, with which alone it breathes. If we dive into the anatomy of the two animals we shall emerge with other characters, which completely distinguish them. The skull of the *Menobranchus* is fixed on to the vertebral column by two joints or condyles while there is but one median condyle in the lizard. The heart is three-chambered in both; but in the amphibian the origin of the aorta from the ventricle is dilated into a thicker walled tube, in which are several series of valves regulating the flow of the blood when it leaves the heart to pass through the arterial system. In the lizard there is no such dilated "*conus arteriosus*," and the persistence of this conus in the amphibian is a mark of its relationship to the lower lying fish, where such a conus always exists. The menobranch has no sternum or breast-bone formed by the union of the ribs ventrally; there *is* such a sternum in the *Lacerta*. The *Menobranchus* lays eggs as does the *Lacerta*; but the eggs of the former are smaller than those of the latter, and do not contain nearly so much yolk. Moreover there is no hard shell such as

covers the eggs of the lizard. The young lizard emerges from the egg a fully formed lizard; the young menobranch is not so identical with its parents, and is therefore hatched at an earlier stage and therefore again sooner. It has a tadpole-like form and is a *larva*, the definition of which term will be dealt with presently.

Excepting for a general similarity in form, every point almost in external structure, not to mention internal structure, differentiates the *Menobranchus* from the *Lacerta*; and if all lizards and other reptiles showed the same differences from all other amphibians there would obviously be no difficulty in defining the two groups. But when we go farther afield, we shall find that most of the points of difference break down. To amend the diagnoses we will recur to the characters used in exactly the same order. While most amphibians are mostly aquatic, there is one group, that of the Cœcilians, which are worm-like creatures burrowing in the soil, and the tree-frogs spend at least most of their time, as their name denotes, upon trees and other plants, while toads are mostly land dwellers. *Per contra* the crocodiles among reptiles are aquatic, as are more entirely so the marine turtles. Certain lizards, such as the Australian Leseuer's lizard (*Physignathus*) spend a large portion of their time in water. Plenty of other examples might be urged in proof of the impossibility of separating reptiles and amphibia by their aquatic or terrestrial habit. Nor can diurnal or nocturnal habits be utilized. Both reptiles and amphibians furnish us with examples of nocturnal and diurnal creatures. The soft body of the amphibian, on the other hand, is a character which is very widely spread, as is the scaly body of the reptile. But here again there is not an absolute line of demarcation. The underground and burrowing lizard *Amphisbæna* has a softish body, though it is true that it does not possess the numerous slime

glands of the amphibian. On the other hand, the also burrowing Cœcilians already referred to have scales. But though the Cœcilians have scales they have also the mucous glands of other amphibia. It is doubtful, however, whether some of the heavily armoured amphibia of remote antiquity, the Labyrinthodonts and their allies, could have possessed much in the way of slime-producing glands.

As to the nature of the limbs, which certainly distinguish so far as their characters go, the *Menobranchus* and the *Lacerta*, there is no possibility whatever of drawing by their help a hard and fast line between amphibia and reptilia generally. In both groups we have reduction of number of digits and of the limbs themselves, culminating in both divisions alike in completely apodous forms. When however we come to the respiratory apparatus, we find at once a difference which holds good throughout the whole reptilian and amphibian series with insignificant exceptions. We may safely state that no reptile ever breathes by means of gills, and that in no reptile is there ever any permanence of the gill clefts. On the other hand in amphibia there may be a sharing of the respiratory functions for life between gills and lungs, and at some time of its life the amphibian breathes only by gills. Moreover there is often a persistence of the gill clefts up to mature life, a feature which the amphibian clearly shares with the fish; in which these clefts, putting the outside world into communication with the pharynx, always persist. In the fish these clefts are divided by bars of cartilage which bear vascular tufts which are the gills. In all the higher vertebrates the embryo shows traces of these clefts; but in the amphibia only do they ever persist into adult life. This leads us to the consideration of the development of the amphibia as compared with that of the reptilia. In the latter the egg is always large

and with abundant yolk. Correlated with the large size of the egg the young when hatched from it is practically adult. Beyond a slight tooth developed upon the snout for the purpose of breaking the eggshell it is like its parent. There is nothing at all comparable to the larval forms of the amphibia. In these latter animals the eggs are not large and have not abundant yolk. Correlated with this is a condition unlike that of the reptilia. The young are born in an earlier condition; and inasmuch as in that earlier condition of necessary incompleteness the young would be unable to lead an independent existence, they have been provided with certain organs which are of use to them only as young and which disappear when they reach maturity. To the young of an animal which leaves the egg in an immature condition, but which has special organs suited to a free life in that condition which later disappear, the term "*larva*" is applied. Many groups of the animal kingdom go through a larval stage. For instance the butterfly leaves the egg as a caterpillar, which is a larva. The caterpillar is not merely an imperfect butterfly. It has special organs of its own. Its jaws for example are not imperfect jaws which later develop into the trunk and so forth of the butterfly. They are complete as biting jaws and disappear when the adult condition is assumed. So, too, the tadpole of our common frog, being hatched at a stage antecedent to the appearance of the later developed lungs, breathes by means of external processes of the skin, which are the gills and peculiar to the larvæ, disappearing when it metamorphoses into a frog. Below the jaw is a sucker which allows it to moor itself to water plants. This structure is not the immature form of any structure which occurs in the frog. It is an organ only found during the tadpole stage; it is in fact a larval organ and its existence is one of the reasons for terming the tadpole a larva.

So with the gills, however long they may last. It is now believed that they are not, so to speak, retentions of the fish gills, but gills peculiar to the larva of the amphibian. To take a third feature in the anatomy of tadpoles: they are most of them furnished with an elaborate series of horny teeth within the mouth; these "teeth" are not later developed into the proper teeth of the frog, nor do they persist when the tadpole leaves the water and begins to croak. They are purely and simply larval organs. In a few amphibians this nearly universal distinction between the two groups under consideration is not to be met with. But if in a given tree-frog the young frog is hatched at once from the egg as a frog, without passing through the preliminary tadpole and tree living stage, it does not follow that that tree-frog must be removed from all other tree-frogs almost exactly like it, and placed with the reptilia. In zoological classification we constantly come across examples of animals most clearly affined to other animals and yet lacking one or more of their important characteristics.

So much then for the difference between amphibia and reptiles. There is no doubt that the amphibia stand on a lower level than the reptiles, and that there are distinct points of likeness to the fishes, some of which have already been touched upon. In addition to those, is the rather important fact that among the amphibia, at least in the larval stages, is a representative of the so-called "lateral line" of fishes. In any fish it can be easily noted that a marked line runs along the sides of the body often dividing the darker colour of the back from the more silvery hues of the belly. This line is formed of a series of sense organs of the nature of touch. In spite of these various points of likeness between the fishes and amphibians, there are profound differences. The most profound is of course that all amphibians agree with the animals lying higher than themselves

in the series in possessing hands and feet, with fingers and toes not exceeding five in number. In no fish, that is or that was, is there the faintest trace of this pentadactyle limb . the fins are of a totally different nature, and there is nothing that is in the least degree intermediate between what has been termed the " icthyopterygium " or fish's fin and the " cheiropterygium " or hand of the higher types. In this particular a vertebrate animal is either a fish or it is not a fish. Furthermore, though some amphibians, the common English newt for example, may appear to be like a fish in possessing fins along the back and so forth, there is this important difference between the amphibian and the fish fin, that the latter are supported by horny gristly or bony rays which do not exist in the amphibian fin.

The existing amphibia may be readily divided into three groups. Of these practically only two concern us here, so that the third group may be summarily dealt with. That group is the Apoda, and it consists of worm-like amphibians which bear not a little resemblance to the amphisbænians among the lizards, and to the typhlopidæ among snakes, in that they burrow underground and live upon worms and such like small game. They are not suited for a life in menagerie, and have never been on view at the Zoo. The two remaining groups are known technically as the Urodela and the Anura, and more popularly as frogs and newts—the tailless frogs being on that very account termed Anura.

The Urodela are always well represented at the Zoo, and we later draw attention to a number of different types. We are here concerned merely with certain generalities about the group. The most remarkable fact about them perhaps is the tendency which so many of them have to retain throughout life certain of the characters of the larva. But as this matter is

treated of under Axolotl it need not be further referred to for the moment. They are, as their name denotes, provided with tails ; and they are also almost entirely aquatic. There are a few exceptions, such as one of our British newts, which is found on occasion without visible means of subsistence in cellars and areas, and such like remote spots, and is as a rule denominated a " reptile " by the finders thereof. The Urodeles are furthermore, with very rare exceptions, impatient of great heat, and are almost limited to the north temperate region. A few stray into Mexico and even South America. There are plenty in Europe, and the most notorious of these is perhaps the white and blind dweller in the caves of Adelsberg, known as *Proteus*. That animal may be often seen at the Zoo. So, too, a variety of newts in the strictest sense of that term. With some other forms we deal immediately. As to the Anura or frogs and toads, there is an immense variety ; infinitely more than there are of Urdeles. With this astounding variety of different genera and species the frogs retain the typical frog form, and no one can doubt for an instant as to whether an amphibian is an Anuran or is not. The Anura are as a rule not so purely aquatic as are the Urodeles ; but there are exceptions, such as the Cape clawed frog, with which we deal later. There is not so much variation in the habits of this group as might perhaps be expected from their large numbers. The supposed flying frog of the East is, as it appears, a bit of a fraud. In successive illustrations of that amphibian the webbing between the toes, which is believed to act as a parachute and allow of flying leaps, seems to have grown in amount. It is merely a tree frog which can leap above the average. Or to put it more accurately, a tree-living frog, not a member of the real tree-frogs or Hylidæ, but of the terrestrial frogs or Ranidæ. The chief variation in habit is really the

more or less completely aquatic life. The frogs are more aquatic than many toads. In external appearance these amphibians differ mainly in colour, and in the degree of wartiness or smoothness which they show. It is plain that the most salient mark of difference from the Urodela is the restricted tail and the fact that they never possess in the adult condition either gills or gill slits. Their fingers and toes, moreover, are never reduced in number, and never, of course, vanish altogether as they do in some of the snake-like Urodeles.

The Surinam Toad

One of the very oddest productions in the frog line is the *Pipa americana*. It is so flat that it seems almost to consist of matter arranged in two dimensions only. The head is small and the front edge of it garnished with many little papillæ. The toes end in star-shaped processes, and the hind feet are webbed with unusual conspicuousness. The toad has got no teeth at all; but it makes up for this incapacity for offence by a considerable capacity for defence. Its body is covered with many little poison glands, with which are sometimes associated little spikes. Most persons have seen a young dog rashly take into its mouth a common toad, and then rapidly drop it; this sudden change of intent is due to the secretion by the toad of a poisonous liquid. The Surinam toad possesses the same properties in a higher degree. The flatness of this amphibian shows that it is intended for a purely aquatic life; and as a matter of fact it does not leave the water. It is harboured in pools in Guiana and perhaps in other parts of South America. It has a method of attending to its young that in all its details is unequalled in the frog tribe. The common frog of this country, when it goes a-wooing, leaves its offspring in the form of those masses of eggs embedded in jelly which are familiar to everybody.

The Surinam toad has not this light-hearted habit of deserting its offspring, and leaving them to the chances of wind and weather. The eggs when produced are piously spread over the body of the female frog by the male, and they are there received into pits which gradually deepen, and are even furnished with a lid, the origin of which is rather uncertain. In these cradles the eggs become tadpoles, and the tadpoles in due course frogs, and after a time they desert the maternal back for a roving life in the surrounding waters of their pool. This paternal and maternal care of the young is known to exist in other frogs ; and such domesticity is not what might be expected from the cold-blooded and small-brained amphibian. But the formation of separate pits in the skin is a feature peculiar to *Pipa*. In other frogs there are pouches of various kinds developed. Since the young frogs are so carefully looked after during their youth, it is perhaps rather remarkable that they go through a tadpole stage outside the egg at all. For in analogous cases the eggs become frogs at once. Whether these tadpoles ever go for a swim on their own account is uncertain, as are many details concerning the domestic economy of *Pipa*. These singular habits were originally and partly related by Madame Merian, whose statements upon South American natural history were received with an incredulity which subsequent investigations show them not to have deserved. It was this same lady who told of vast bird-eating spiders and of many " curiosities of natural history," which actually occur or exist. This *Pipa* displayed its breeding habits at the Zoo some few years back. But whether it was that the mother was disquieted by the crowds that vulgarly stared in upon her domestic privacy, or that the water was deeper than was suitable to the proper aeration of the tadpoles in their nursery, they all failed to develop except a single tad-

pole ; the life of this tadpole was cut short by alcohol, and it now reposes as a " specimen " in a glass bottle of spirits of wine. It ought to be added that the *Pipa* is tongueless as well as toothless, and that on this account it is referred to a group of frogs which are scientifically termed the *Aglossa*. It is probably not unrelated to the Plaathande or Cape clawed frog, *Xenopus*, with whose peculiarities we deal on another page.

The Adorned Ceratophrys

Had the New World been discovered when Æsop wrote his fables, and anything known of its inhabitants, there is no doubt that that fabulist would have selected this toad to illustrate his fable of the Frog that would be an Ox. For it is not only of considerable size, quite as big as a blacksmith's fist, but it puffs itself out under certain circumstances productive of annoyance until it is perfectly rotund, and still further increased in size. *Ceratophrys* is a genus of amphibians with several species, all of which inhabit South America. There are always examples at the Zoo, so that their characters can be studied at any time. Externally they present the appearance of toad, that is they have a peculiarly evil aspect, and are lethargic in gait, sitting for the most motionless esconced in a " form " which they excavate or rather push into. The term toad as opposed to frog is somewhat difficult of definition, and indeed cannot be used. The more edentulous members of the group may perhaps be called toads ; for the common toad as compared with the common frog of this country, is edentulous, having no teeth on the upper or lower jaws. Or a squat form with a warty skin may be selected as the test. But in this case some of the family Bufonidæ, *the* toads *par excellence*, will have to be excluded. On the whole the term toad had

better be kept for the common toad and its immediate allies, and the rest of the Anurous Amphibians, or Batrachia, as their technical name goes, be called frogs. The *Ceratophrys* derives its name from the horn which in most of them surmounts the upper eyelid and adds to the fierceness of their aspect. The size of its mouth is exaggeratedly amphibian ; and well it may be, for the beast is extremely partial to its own kind and even to its own species. It will gulp down quite a large frog without winking, or rather, to be more accurate, with that slow closure of the eye which is a necessary consequence of the structure of its throat and head. As the *Ceratophrys* is, as a rule and when undisturbed, toad-like in its equanimity, it is well for it that its hues assimilate so conveniently to the hues of a marshy environment. Squatting down at rest in a shallow depression which conceals its " inglorious belly," the mottled green and brown of the back suggests a lump of earth partly overgrown with Confervæ. Thus the frog has only to sit tight and the revolving hours must bring within its unerring grasp some wandering insect or reptile. These are seized and bitten with a very sharp and strong dental apparatus at the front of the mouth, which can also inflict a painful bite upon the human subject. The *Ceratophrys* is at times a peculiarly irritable amphibian. If handled disrespectfully it puffs itself out vastly, then gives vent to a sound not by any means unlike a sharp bark. That bark is not worse than its bite by any means ; it is indeed the prelude to a forward jump combined with a snap. To outward appearance this frog is not widely different from other frogs. It is perhaps a little more apoplectic in its contours. Head merges into trunk with even less suggestion of a neck than in others of its race. Internally some of the species, including *Ceratophrys ornata*, present us with an interesting survival from past times, as we perhaps assume

it to be. Under the skin of the back is a bony plate, which is to be looked upon, as far as our present knowledge goes, as a relic of the largely developed skin armature of some extinct forms of amphibians belonging to the well-known Labyrinthodonts. The green colour is quite an amphibian green ; it might be termed perhaps, —according to a classification of greens that we have seen recently, neither light nor dark, but " pleasing." Specimens have been on view at the Zoo at any rate since the year 1859.

A Green Tree Frog

It is a common belief that all tree-frogs are green. This is not the case ; some are mottled brown and of the general Batrachian colour. But a good many are green ; and, as is the case with green tree-snakes and green tree-lizards, it is probable that they suck some profit thereout. The invisibility, however, is due to colour and not to form. Flat and adpressed to the leaf or stem though the frog sits, it is said that a photograph at once betrays its presence. Nature or a water-colour drawing may be deceptive ; not so the camera. With the exception of three species, of which one, that concerning which we shall have something to say here, is European and Asiatic, the tree-frogs are confined to America and to Australia. Since they are not always green, it becomes important to be able to say what a tree-frog is by some other method than a mere inspection of colour. The Hylidæ, called after the youth beloved of the Naiads, but who declined to dwell with them in fountains, differ from most other frogs in the adhesive pads developed upon their fingers and toes which allow them to sit tight upon smooth surfaces, and the existence of teeth in the upper jaw. The former character alone is not enough. The common tree-frog, *Hyla arborea*,

ranges from the south of France to Japan by way of southern Europe and Asia Minor. Its northernmost haunt is the south of Sweden. The little frog is not more than two inches long, and indeed tree frogs as a rule are small. This particular species, though it lives in trees, descends to ponds to lay its eggs, from which emerge in due course tadpoles. One Hohenheim, who modestly styled himself Aureolus Theophrastus Bom-

AUSTRALIAN GREEN TREE FROG.

bastes Paracelsus, and is better known by the last of his four invented names, thought or more probably only said, that frogs exist in the firmament from which others arise, and are thrown down by the impact of tempest; that they also produce seed in May which falls upon the ground and from which tree-frogs are produced. This is one of the oldest versions of the old "shower" theory of the birth, or at least migration, of frogs; it is of course to be explained by the simultaneous hatching of innumerable frogs which "wander at will o'er the meadows" in search of suitable trees. So Rösel von Rosenhof, a historian of the frogs of Germany in 1750,

tells us. Tree-frogs gulp down their prey, stuffing it into their mouths with their hands. They do not flash out a tongue causing the fly to instantaneously disappear like other frogs and toads. And for the good reason, that their tongue is but slightly protrusible. *Hyla arborea* can, like most frogs, change its colour. There are more tree-frogs of this group than there are members of any other group of amphibians. The Zoo constantly harbours examples of a large Australian form, *Hyla cærulea*, (which is represented in the accompanying figure), a badly applied name since it is *green* with bright white flecks. These white flecks have been held to suggest to the pursuing snake spots of mildew or spots of sunlight, and thus to dissuade him from attempting to devour something so obviously inanimate. These frogs, like the European tree-frog, lay their eggs in water. As a matter of fact the breeding habits of tree-frogs are most varied; some carry the eggs about attached to their bodies in various ways. Others make nests of greater or less elaboration even upon trees. A species in Japan, apparently of this group, constructs something that looks like a hornet's nest, which is full of eggs, and, later, tadpoles, which would after a time seem to drop into water lying beneath.

But this bird-like fashion of making nests in trees and then laying eggs in them is not confined to the Hylidae. Nor, of course, is the mode adopted by some of carrying the eggs about the person, even as in Nototrema, where a sac developed for that purpose exists in the skin of the back. We have already considered the strange case of *Pipa*, which does the same thing.

It is odd that the tree-frog, like the Irishman, keeps dry during a storm of rain by getting into a pond. Of course one explanation is that the leaves get rather too slippery for the frog conveniently to adhere to them. It is frightfully noisy, and is possibly the frog which

has gone down to posterity as having kept Horace awake during his journey to Brundusium.

The Plaathande

The examples of *Pipa* in the Zoological Gardens were separated from some frogs in another and neighbouring case by a tank, in which a few tortoises disport themselves. The two frogs are also separated in nature by a more considerable tank, also full of turtles, the Atlantic ocean. On the American side lives the Surinam toad, and on the African the plaathande of the Dutch colonists, known to science as *Xenopus* or *Dactylethra lævis*, the "smooth-clawed frog." The two frogs and a third and less known genus are commonly associated together into a group called Aglossa, on account of the absence of a tongue, and by virtue of other peculiarities which give them an isolated place among frogs and toads. Like *Pipa*, *Xenopus* rarely leaves the water, and our illustration shows its characteristic pose when doing nothing in particular, a form of action in which it is a proficient. It has a flat back when it can be induced to sprawl awkwardly about upon dry land, and does not sit up in the perky fashion of *Rana*, or even of the lugubrious Bufo. The latter present an appearance of a breakage in the back, which is really due to the projection forwards of the bones of the hip girdle. While most frogs are noisy, *Xenopus* does not by any means make the welkin ring. No sleep would be averted by these marshy frogs. The very ghost of a croak, described as "Tick-tick," and not the virile "Brek-ek-ek-ek coax coax" of Southern Europe, of to-day as well as in Aristophanes' time, is all that they produce. And even this requires the tender passion for its excitement. It is only in the breeding season that the frogs make vocal the neighbouring glades. Another characteristic of the lower amphibia shown by the Plaathande is its habit of laying eggs not

in the stalwart balls familiar to us here, but in a niggardly way, by twos and threes. Being so purely

CAPED CLAWED FROG.

aquatic, it is not surprising to find that many parts of the structure of this frog are eminently suitable for a

life in the pond wave. Their hind feet are most obtrusively webbed, and along the sides of the body are a row of what look like rather careless stitches ; the baggy and ill-fitting appearance of the frog suggests an amateur attempt at repair. These stitches are in reality the organs of the lateral line, a structure found in the lower amphibia and in fishes, a sense organ probably of the nature of touch. The absent tongue is also apparently to be looked upon as the result of an aquatic life, where food slips into the mouth and is not manœuvred thereto by the prehensile organ of the buccal cavity. The lungs are assisted in their contractions by a very complicated system of muscles, as are those of *Pipa*. This is exactly analogous to the increased diaphragm in whales and in other aquatic mammals, and is a very remarkable instance of how Nature attains to the same result without the manufacture of a special organ. A new one is simply made use of, and, if need be, increased and altered. An imperfect representative of the Xenopine and Pipine "diaphragm" exists in *Rana*. There is nothing peculiar in the breeding habits of *Xenopus*, such as occurs in its ally *Pipa*. It lays eggs in the ordinary amphibian way, and therefrom emerge tadpoles. These tadpoles are quite as interesting in their way as are their parents. Some few years back there were swarms of them at the Zoo, a pair of the frogs recently brought back from Zanzibar having laid eggs. They have not bred since, but there is always the chance of their doing so. The home-bred tadpole is familiar enough to everyone by its imp-like aspect and alluring wrigglings. The tadpole of *Xenopus* is about as different as it can be and yet remain a tadpole. It is clear and glassy in colour, with only a faint amount of pigment here and there ; and it has a fascinating way of standing upon its head at the bottom of the tank and wriggling its tail violently.

CANNIBAL TADPOLES

These tadpoles are very carnivorous, and feed upon minute water crustaceans. The black tadpoles of the British puddle eats decaying vegetation, though on occasions it will become a pure cannibal. At the sides of the mouth of the Plaathande tadpole are a pair of very long feelers, which must be tactile, and when first described led the describer to place the animal as an adult creature in the neighbourhood of some of the Siluroid fishes, whose heads are beset with such tentacles. In the *Xenopus* tadpole the tentacle gets less and less important with advancing days, and finally remains in the adult as a small process under the eye, which can be recognised in the illustration.

The Fresh-water Siren.

Since the year 1876, when the first example was received, there have been always, or at any rate generally, specimens of this newt-like and American creature in the Zoological Gardens. The siren (*Siren lacertina*), eel-like though it appears, belongs to the great group of the amphibia; like the Japanese newt (*Megalobatrachus*), like the little English newt, and the axolotl it belongs to that division of the amphibia known as the Urodela, from the fact that they have tails, which the frogs and toads have not. All these tailed Batrachia are inhabitants of the temperate regions, only just getting into South America, not reaching tropical Africa, and totally absent from Australia and its adjacent and heated islands. It is not indeed too much to say that they represent in cooler waters the tropical mud-fishes, *Ceratodus*, *Lepidosiren*, and *Protopterus*. Where there are Dipnoi there are no tailed amphibians and *vice-versa*. As it is not unreasonable to trace the origin of the tailed amphibians, which are clearly the most primitive of existing amphibians, from some dipnoid form, these

facts are not without interest. Why this black and slimy newt should be called *Siren* is not clear. They do not chirp or sing, and indeed are voiceless, like other newts. They are not enchantresses and do not play on cords. On the contrary, they are black and evil-looking, not alluring except indeed to the naturalists, to whom they present many points of interest. This animal grows to about two feet in length, and lives exclusively or at least very nearly entirely, in muddy ditches, where it finds its animal prey. The accurate John Hunter was the first to detect the real nature of the siren, and placed it between amphibians and fishes. A retrograde step was taken by Camper the Dutchman, who called it a muræna, or eel, an error which is perpetuated to-day by its vernacular name of "Mud-eel," The siren has external fringed gills like the axolotl. But there is no reason to suppose that it is, like the axolotl, a larval form ready to blossom out into a more fully formed and gill-less newt when forced to leave its streams. For in the first place its degradation is shown by the missing hind limbs, and in the second place it has a set of larval gills which give place to the therefore permanent gills of the adult. It has had its chance as a larva, and has failed to take advantage of it. As with other aquatic creatures, it is the hind limbs which have gone. Thus the whales have not a trace of these: and in the seal and sea-lions they are more or less bound up with the tail, and clearly on the wane. In terrestrial animals which have undergone degeneration, it is rather the fore limbs that go first, as witness the snakes and many tail-less lizards.

The Axolotl

There is nothing more interesting at the Zoo than the swarthy American newts, called axolotls, unless it be

the white axolotls, often to be seen in adjoining tanks. As in the case of many other creatures, albinism occurs not infrequently ; and the milk-while albinos, with their red gills, are of striking appearance. In many years a series of experiments, conducted, though without a licence, upon living animals, are undertaken upon the *corpora vilia* of these axolotls. The experiments consist in gradually reducing the depth of the water at one end of the tank by means of a shelving board. Up this board it is hoped with unrewarded persistence that these axolotls will creep, and having arrived at dry land will cease to be axolotls at all and become amblystomas. The axolotl, in fact, is a creature that has discovered the secret of perpetual youth. But this desirable discovery is tempered by the pains and cares of maternity. For the axolotl is simply an unwieldy and overgrown tadpole ; but a tadpole which has abandoned some of the frivolity of youth and assumed family responsibilities by the laying of eggs, which duly hatch out into fresh series of axolotls. It was discovered a good many years ago that the gills of the axolotl are directly comparable to the gills of tadpoles, and that the growth of the newt was usually, and for a long period sometimes, indefinitely arrested at the tadpole stage ; but that under certain circumstances, especially the drying up of the surrounding water, the gills withered away and other changes took place ; these changes convert the water-living axolotl into a land-living newt of, as was once thought, quite a different genus, viz. *Amblystoma*. It is a fact that the progress and growth of the axolotl must be encouraged, not forced. The newts must be induced to take to a land life by cutting short their supply of water. It is no use trying the violent method of snipping away their gills ; for the only result of that is that they grow again, and a more obstinate axolotl is produced. But it has been shown that an artificial

restriction of watery environment will often make *Amblystomas* out of axolotls. The case of the axolotl is not so unique as was once thought. "Neoteny," as this extension of childhood is scientifically called, both occurs normally, and can be produced in various amphibia. Even in frogs, the tadpoles can in the case of some species be compelled to remain tadpoles for a long if not indefinite period of time, behaving, however, precisely as tadpoles, though swollen in bulk; the two frogs of this country, viz. *Rana temporaria* and *R. esculenta*, are instances to the point. But these tadpoles, if they do not ultimately become frogs, die as tadpoles without begetting fresh tadpoles. The axolotl and the common newt of this country, as well as other newts in the strict sense, that is to say, of the genus *Triton*, not only retain their larval characters, but are able, as we have seen, to breed as such. These facts lead us to some highly interesting conclusions. It used to be a common idea, which had the advantage of seeming quite philosophical, that the existence of external arborescent breathing organs in such amphibians as the axolotl and the Japanese salamander, were proofs of the antiquity of these forms. The retention of the fish-like mode of breathing by gills seemed to argue a basal position in the amphibian world. Not so, however, do we now think. For it is clear that some at least of the gilled forms are merely precociously developed young, which, taking time by the forelock, commence breeding before structural maturity, and that others, like the Japanese salamander, may be (here we can only guess for the present) entirely similar in origin. Hence it is clearly a recent modification which we are dealing with; and therefore the types which, like the frog, have not given rise to a persistent and sexual larval form are the older.

Cortez, when he descended from his "peak in Darien,"

saw the axolotl in the lake of Mexico, and very probably ate it upon toast. Anyhow, the descendants of his followers do at this day.

The Giant Salamander

"A monstrous eft," wrote Tennyson, was lord of all in past æons. At the present moment a distinctly monstrous eft is lord of a smaller portion of the earth's surface, of certain streams, that is to say, in Japan. This animal, known as *Megalobatrachus japonicus*, or *Sieboldia maxima*, has been frequently exhibited at the Zoo, since the year 1860, when the first example was obtained. The specimens at the Gardens do not, as a rule, indicate the colossal size to which this, the largest of existing amphibians, attains. But recently, at any rate, an individual of very fair proportions was alive; this newt measured about four feet. The "outside" length appears to be as much as five feet. The illustrious German naturalist, von Siebold, brought back from Japan the very first specimen ever exhibited in Europe, so long ago as 1829; and the animal—there were originally two, but the larger devoured his mate—lived until the year 1881. To anyone familiar with the aspect and general demeanour of this great newt, its longevity will not come as a surprise. It passes its days, and, so far as one knows, nights, in a state of almost lethal repose. So little agitation is there of the body and mind that the difficulty is to understand why it should die at all; and it is plain that if a specimen of unknown age lived in captivity and therefore presumably under disadvantageous conditions for fifty years, its normal life might be indefinitely stretched out.

In its native Japan the eft is termed "Hansaki," "Hazekoi," or "Anko." It inhabits mountain streams

in the mountains of Iga and Hiruze ; as a rule the larger the streams which the eft inhabits, the larger the eft itself, precisely as in the case of other freshwater creatures. It will be noticed that the animal has not, what some others of the Urodele amphibians have, any vestige of external breathing organs, the gills or branchiæ. Nor is there the least trace of a cleft which is associated in other amphibians with such gills. In this it differs from the very closely allied, though smaller, North American *Menopoma*, or "Hellbender," as its singular vernacular name runs. Both animals are often together at the Zoo, and in adjacent tanks, so that they can be easily compared. Our salamander has a great flat head, a warty body of a brownish olive to almost black in hue. The limbs are fully developed, which is not always the case in its allies, and terminate in the usual five but stumpy fingers and toes. It nourishes itself in its native haunts upon little fishes and other aquatic creatures, which it hardly pursues with effort, but simply snaps up when they are so imprudent as to venture within reach of its jaws. The only time when this lethargic inhabitant of the waters shows any activity is the breeding season in August and September ; it then moves about with more frequency and rapidity, and, like our crested newt, assumes a slightly brighter coloration. These amphibians have never bred at the Zoo ; but lately they have at Amsterdam ; and Dr. Kerbert, of the Zoological Society of that city, has been able to watch them and report upon their behaviour. It is quite possible that such a happy occurrence may occur at our Zoo ; for no particular help in the way of running water or larger accommodation seems to be necessary. This newt, like others, and even after the fashion of some frogs and toads, deposits its eggs not in a mass, such as we are all familiar with in pools in this country in the early spring, the work, of course, of the common

frog, but in festooned ropes, consisting of a single row of eggs, which are connected by glutinous matter, and moored by it to handy rocks and stones. This provision of nature is very intelligible in view of the localities in which *Megalobatrachus* dwells. For in rapidly-moving streams the eggs, if laid singly and without this viscous protection, would be liable to be carried off and destroyed in the sea. As it is they remain anchored safely until the appearance of the young. The lady salamander, having done her duty in producing the eggs, leaves the equally important task of watching over them to her mate, who is so assiduous that he will not even allow the mother to visit her progeny, but at once drives her away. The little salamanders when they leave the egg are about an inch long, and they have, like the larvæ of other amphibians, external branching outgrowths, which are the gills.

The Mud Fish

The mud fish of Australia, *Ceratodus forsteri*, is one of the latest additions of importance to zoological literature. Before the year 1870 it had inhabited unremarked its native rivers; in that year it was for the first time described, and to the Zoological Society. It is peculiarly appropriate therefore that the first living specimens to reach Europe were those acquired by the Zoological Society and deposited in the Gardens a year or two back. The pair now in the Reptile House are believed to be a pair, that is, a male and female; but they have shown no anxiety to prove this view by laying eggs; this, however, is a matter for less regret at the present moment, since the breeding habits of the fish and the nature of its hatched-out larvæ have been made known to us by Dr. Semon, who voyaged to the remote spots, selected by *Ceratodus* as a dwelling-place,

in order to ascertain the facts. It is only in Queensland that *Ceratodus* is met with. In the Mary and Burnett rivers it occurs in deep quiet pools, which are full of water in wet and dry seasons alike. Some persons, impressed doubtless with the real likeness which this "fish" bears to the amphibia, have asserted that it basks in a crocodile-like fashion upon logs. The *Ceratodus*, however, cannot leave its native streams; and instead of showing the least trace of an amphibious way of life, it dies with peculiar ease when removed from the water. It is probable, thinks Professor Baldwin Spencer, that a large water lizard, common in and along the banks of the same rivers, is responsible for the stories of the *Ceratodus* basking upon tree trunks.

With the laudable view of preserving so far as possible this interesting survival from a bygone age, steps have been taken in Australia to transfer this fish to other rivers, where it apparently does well. Our descendants may find that if these experiments continue to be successful, the *Ceratodus* may lose some of its peculiarities. At present the rivers in which it swims are not quite ideal as fish reservoirs. During the hot weather ill weeds grow apace, and also decay: there results a fouling of the water and a concomitant lack of pure air, and an increased difficulty for the Barramundi to breathe. Nature, however, though a strict economist, invariably permits, or rather insists upon, the wind being tempered to the shorn lamb. The dyspnœic *Ceratodus* has, in consequence of these difficulties, acquired a swim bladder which performs the offices of a lung, instead of being merely, as in other fish, a hydrostatic apparatus The lung has its own special artery and vein exactly as in other creatures with lungs, and the fish comes to the top of the water to inhale air, just as any land-frequenting but occasionally aquatic and diving animal does. In addition to this, it has the

AUSTRALIAN MUD FISH.

gills of the fish, which are adequate enough in favourable conditions. It is in fact exactly in the condition of a rather elderly tadpole. The very young tadpole has merely gills like a fish; later on, the lungs appear, while the gills persist; later still, the gills vanish and the lungs alone remain: it is, however, now a frog. *Ceratodus* remains for its whole life in the tadpole condition. It would not be a gross exaggeration to describe it as a huge scaly tadpole.

The Australian mud fish is one of those "friendless" creatures, a survival from past times, when creatures were apt to be a little less decided as to their relationships than at present. It is a link between fishes and amphibians. *Ceratodus* itself has not a tadpole; but its near allies, the African mud fish, *Protopterus*, and the South American *Lepidosiren*, have newly-hatched larvæ which are immensely like young tadpoles. Everybody must have noticed the way in which the tadpoles of our common frog hang on to the leaves of aquatic plants by their chin, which they press firmly thereto as the Red Queen pressed her chin upon the shoulder of Alice. A sucker achieves this anchorage, and the same sucker is present in the young mud fishes of America and Africa. The Paraguayan mud fish, once so scarce that it was represented in European museums by about three specimens, has long furnished a succulent meal in certain regions of South America. It has been brought home in abundance and carefully studied by Professor Graham Kerr; it is therefore not by any means unlikely that the visitor to the Zoo will have the opportunity of seeing side by side this creature and its Australian relative. In any case he will be practically certain to have the chance of seeing *Protopterus* of Africa.

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